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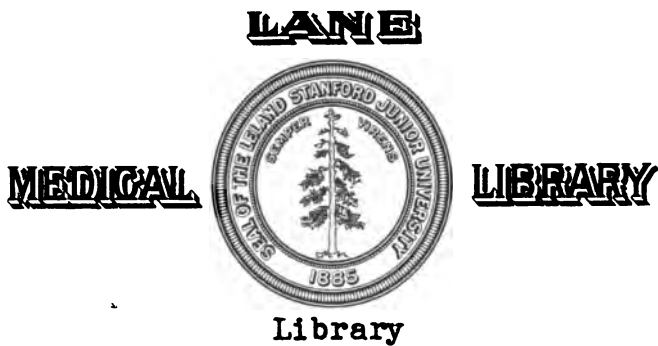
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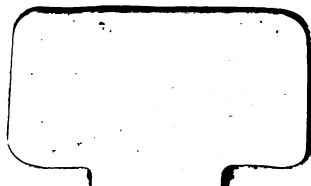
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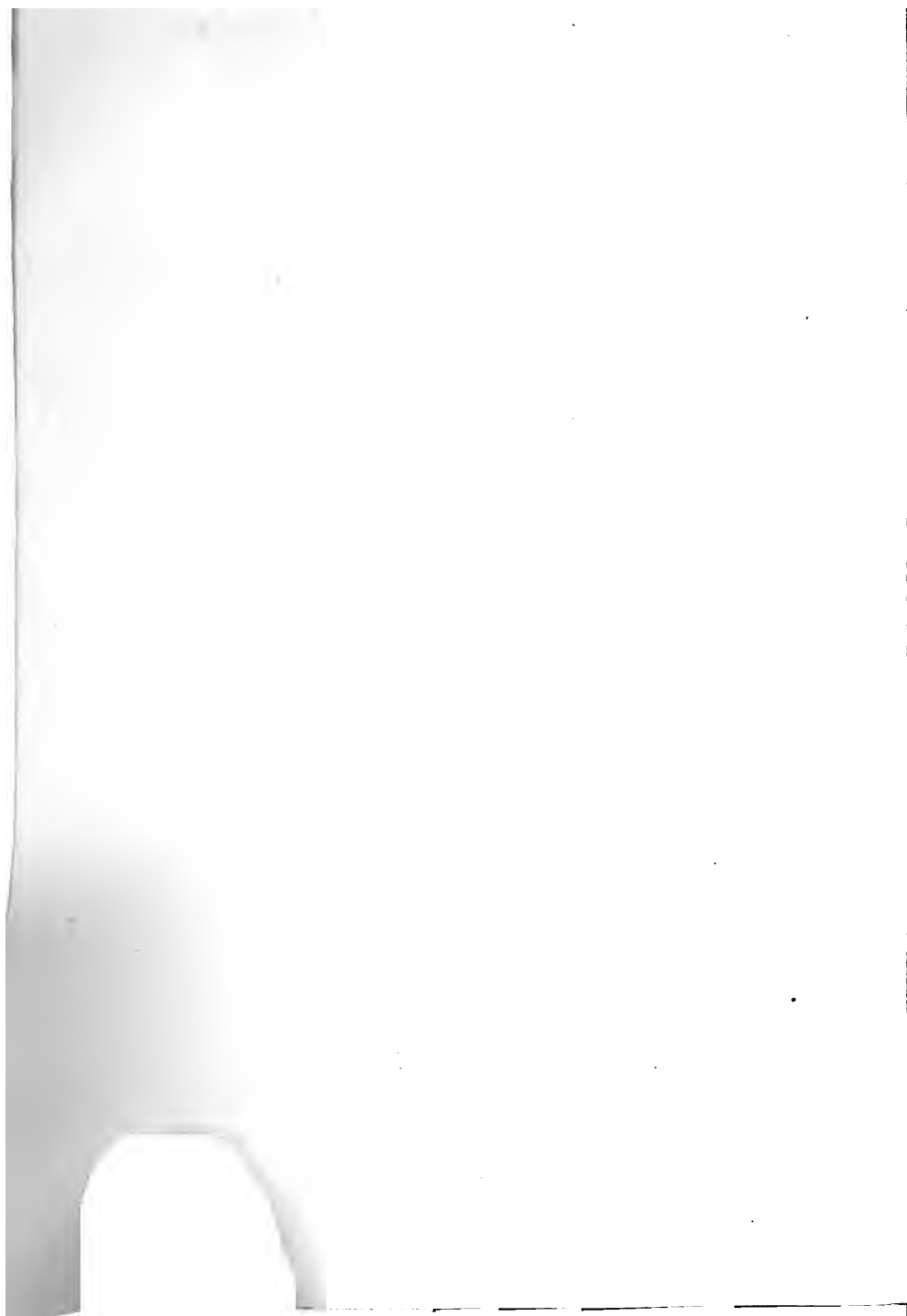
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PYORRHEA ALVEOLARIS.



DEDICATED TO
DR. MATTHEW A. BARBER
A TRUE FRIEND, TEACHER, AND SCHOLAR.

78654



1. The mouse is a small rodent with a long tail and small ears. It is often found in houses and gardens. It is a common pest and can cause damage to food and property. It is also a common pet animal.

PYORRHEA ALVEOLARIS

By

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ILLUSTRATED

ST. LOUIS

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1913

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PREFACE.

The opinions as to the cause and treatment of pyorrhea are as diverse at the present time as they were many years ago. The most common belief of the dentists is that the disease is a local process. The author, after careful observation covering a number of years, does not agree with this theory, but believes that the disease is the result of constitutional and exciting causes which lower the vital resistance of the alveolar process, gum, and the peridental membrane. The body, in other words, is out of harmony physiologically, and as a result thereof, manifests itself in the alveolar process, the gum, and the peridental membrane.

Accepting the statement that the above postulates are correct, there are also diseases which are complications of pyorrhea. The oculist examines the teeth and the gum of his patients, for he has learned that if they are diseased their condition affects the eye reflexly. The aurist has learned that unhealthy teeth and gum are factors of great importance in diseased conditions of the eustachian tube and the middle ear.

The laryngologist examines the teeth and the gum for he, too, has learned that they are factors in the production of tonsillitis and diseases of the throat. The internist of today is not like his colleague of a few years ago, who laughed at the possibilities of complications resulting from diseased teeth and gum, for he has learned that they are of importance in such diseases as are the result of micro-organisms, pathogenic in type. The tonsil, it is taught, is one of the common avenues for the invasion of micro-organisms into the body. As a rule, micro-organisms are present in pyorrhea and are held in suspension by the pus. The pus is constantly exuding from around the neck of the tooth at the gum margin, being mixed with the saliva and swallowed. In the act of swallowing a portion of it passes over the tonsils. Some of the organisms contained in the mixture of saliva find lodgment in the crypts of the tonsils. After an indefinite time they commence to grow and by their growth inflammation results. As a result of this process the normal resistance of the tonsil is lowered, after which the organisms, in all likelihood, gain ingress into the lymph stream and thence to the general circulation. After their ingress they are carried to the finer

capillaries, and if the bodily resistance is low they are lodged in them and soon commence to grow. If the point at which this process happens is the endocardium of the heart, an endocarditis will result. This is not a mere dream, but in all probability a process which actually occurs.

From the above examples can be readily conceived the possibilities resulting from diseased gum and demonstrates that pyorrhea is a disease which must and will receive a great deal of attention. Much is to be done and the field offered the investigator is a broad one, for very little work has been done thus far on this subject. In the past it has been looked upon as of little importance; but in all likelihood it is of great consequence in all departments of the healing art. It is a disease which is amenable to treatment and the author sincerely hopes that the future will simplify and improve to such definite end that the disease can be treated by all men of the healing art and that they will be rewarded with success for their efforts.

FRIEDRICH HECKER.

KANSAS CITY, Mo.,
November 1, 1913.

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PYORRHEA ALVEOLARIS

CHAPTER I.

Varieties of Pyorrhea.

The author has for a number of years kept notes of observations made on the gums and teeth of patients afflicted with pyorrhea. In each case a history was taken, and in addition thereto the findings of an examination of the gums and the teeth. With these findings the author has classified the disease into the following varieties:

- I. Diabetic Variety.
- II. Interstitial Nephritic Variety.
- III. Infective Variety.
- IV. Gastro-Intestinal Toxemic Variety.
- V. Pre-senile Variety.
- VI. Senile Variety.
- VII. Variety Resulting from Trauma.
- VIII. Variety Resulting from Chemical Irritants.
- IX. Variety Resulting from Mechanical Irritants.
- X. Variety Resulting from Thermal Irritants.
- XI. Variety Resulting from Bacteriological Irritants.

A complete description of the eleven varieties mentioned above is given in the following pages:

DIABETIC VARIETY.

Etiology.—The diabetic variety of pyorrhea is a complication of diabetes. It generally manifests itself after the disease is well established, occurring between the ages of 25 and 50. The predominant number of sufferers which have come under observation were married women, and as a rule mothers. They have not been of the poorer class, but of the middle class and the rich—the greater number were among the rich. The sufferer usually is without worry, and leads a very sedentary life.

The exciting causes—trauma; chemical, mechanical, thermal and bacteriological irritants—are of great importance. The tissues around the teeth like the other tissues of the body are poor in resistance. Hence, any one of the above factors has the ability to bring about a local destruction of the gum, the peridental membrane and the alveolar process.

Pathology.—In this variety the gum around the teeth during an acute exacerbation is of a beefy-red color in contrast to the normal pink of healthy gum tissue. It is sensitive, and

on gentle pressure there appears at the gum margin a thin whitish or cream colored exudate which is small in amount. If the gum is massaged a profuse hemorrhage occurs from the area thus treated. The hemorrhage is very persistent and difficult to control. In this variety of pyorrhea the painfulness of the gum is not relieved by bleeding. It is observed that the teeth are markedly affected by extreme tenderness, which in some instances is so severe that the patient constantly refrains from using them in mastication, and is very careful in conversation or at rest not to bring them into occlusion. The exacerbations come on at irregular times and vary in length of duration. One can, with little discomfort to the patient at the time of an exacerbation, pass a thin-bladed instrument for a considerable distance between the root of the tooth, the gum and the alveolar process. As the attack subsides the depth of the pocket becomes less than during the exacerbation. The depth of the pocket, as a rule, is dependent on the severity and the number of previous attacks. With each attack the pocket reappears and is increased in depth and extent around the root of the tooth. The diseased condition of the gum, the peridental membrane and

the alveolus is progressively worse with each exacerbation. The teeth, because of the loss of tissue, become greatly loosened, in some instances so loose that extraction is necessary.

Bacteriology.—In the diabetic variety there are, as a rule, a variety of organisms, with one of the staphylococci predominating.

Diagnosis.—The diagnosis of the disease is made on the history or urinary findings of diabetes. This fact is generally known to the patient and if not should be confirmed by making a test for sugar. (The Fehling test can be quantitatively or qualitatively made.) The beefy-red color of the gum in contrast to the normal pink gum tissue, the acute overwhelming exacerbations, the sweet odor of the breath, and the urinary findings are sufficient to make a positive diagnosis of this variety of pyorrhea.

Differential Diagnosis.—The diabetic variety is differentiated from the *Interstitial Nephritic Variety* by the urinary findings which in the interstitial nephritic variety does not contain sugar, but albumin; and by the character of the gum around the teeth involved, which is not of a beefy-red color. It is differentiated from the *Infective Variety* by the history and character of the onset of the attack; from the *Gastro-in-*

testinal Toxemic Variety by the sudden onset, soreness of the gum (which is quite general), malaise, nausea, and headache; from the *Exciting Varieties* by the history and the presence of factors which have to do with the production of this variety; namely, traumatic, chemical, thermal, mechanical and bacteriological irritants. After the presence of any one of these, landmarks are left which cannot be confused with the diabetic variety of pyorrhea.

Symptomatology.—In the diabetic variety of pyorrhea the patient at intervals varying from three to six weeks has an exacerbation which is ushered in by malaise, irritability, nervousness, and pain which is neuralgic in character. The length of the exacerbation is from 2 to 7 days and in some cases it becomes so overwhelming that the patient goes to bed. At the commencement of the attack the gum around the teeth involved is painful on pressure. The gum is swollen, and bleeds readily, and after the hemorrhage has commenced it is rather hard to control. The teeth at the beginning of the exacerbation are not painful when brought into occlusion, but as the attack progresses they feel elongated, are loose, and painful when brought together. The height of the attack is generally

reached within 48 hours. After this time the above described symptoms gradually subside, the gum and teeth involved feeling quite comfortable after the eighth day. The attack having passed off, the color of the gum again becomes approximately normal and a period of rest is established. After an indefinite period of time another exacerbation comes on involving teeth which were not attacked by the preceding exacerbation, and the teeth become so loose that they interfere with mastication and articulation. After the disease has become well established, the gum is constantly more or less hypersensitive to slight pressure and bleeds freely when brushed. As a result of these two inconveniences, the patient does not care for the teeth as faithfully as in the beginning of the disease, and consequently pockets of pus are many times present in the chronic stage of this variety which, if not cared for by evacuation, will cause the patient great pain and will burst on the surface of the gum. If this occurs it complicates the condition and is a hindrance in the treatment.

Prognosis.—The prognosis of the diabetic variety of pyorrhea is dependent on the age of the patient and duration of the disease. As a

rule a prognosis of fairly good results can be offered the patient.

Treatment.—The hygienic treatment in the diabetic variety is of great importance, and thorough prophylaxis on the part of the patient and the dentist is necessary. If the disease is characterized by the presence of pus at all times with an increased amount during an exacerbation, the first step in the treatment is for the physician to prescribe a diabetic diet and treatment, which will raise the immunity of the patient generally and especially the immunity of the tissues on which the teeth depend for their position and relation. The physician having prescribed, the next step is vaccination of the patient with an AUTOGENOUS BACTERIAL VACCINE.

INTERSTITIAL NEPHRITIC VARIETY.

Etiology.—The interstitial nephritic variety of pyorrhea is in all likelihood a complication of interstitial nephritis and occurs after the fortieth year. This variety of the disease is found most often in men, although it is sometimes observed in women. The social conditions are of no importance in this variety, for the disease is found among paupers as well as among the

rich. The occupation of the afflicted person may be that of a laborer or banker.

In the modern teachings of medicine it is held that alcohol is an etiological factor in the production of nephritis. Hence, as a result of this deduction, alcoholism must first be considered as a factor of great importance in the production of this variety of pyorrhea. The next most important factor is the bacteria, for in this variety the immunity of the tissues around the teeth is very low and as a result thereof they find them an excellent field for their growth. The presence of the products of bacteria diminish the local and general immunity, and if the sufferer is an alcoholic the immunity is further diminished.

The remaining exciting causes are the mechanical irritants; namely, ill-fitting plates, bridges, band or porcelain crowns, tartar that is of a soft putty consistency and of a pale yellow color at the gingival margin. Trauma, if of the contused variety, increases the diminished vital resistance of the tissues, and they are lost, either by the action of the bacteria and their products or by local necrosis. The thermal irritants such as very hot food or drinks, are capable of producing an irritation of such se-

verity, which, if not treated, many times terminates in the destruction of a small or large amount of the gum tissue.

Pathology.—The onset of the interstitial nephritic variety and after its establishment is characterized by mild exacerbations. This variety of pyorrhea is very slow in its progress, the tooth or teeth first involved being only slightly painful on occlusion, with no looseness. As the disease progresses, the teeth gradually become loosened and the teeth on occlusion become painful. The looseness of the teeth is increased when an exacerbation comes on and remains so during it. The gum gradually recedes from the necks of the teeth, exposing the roots for a variable distance, depending on the duration of the existence of the malady. The roots of the teeth in some cases are smooth while in others they are rough, having a fine deposit on the surface that feels flinty when rubbed with an instrument. The gum during an exacerbation has a dark bluish-red color. It is swollen and painful on pressure, but if the pressure is continued the pain becomes very slight and there exudes from the gum margin a thin, white exudate which in some instances has a very foul odor. This odor is observed many times by the

patient who as a result calls on the dentist, complaining of this odor and the looseness of the teeth.

Bacteriology.—In this variety of pyorrhea it is found microscopically that a variety of organisms are present, the *staphylococcus pyogenes fetidis* being the predominating one in the smear and culture.

Diagnosis.—The diagnosis is made on the character of the onset of the disease, the age, the sex, the color of the gum as compared to the normal pink of healthy gum tissue, the history of interstitial nephritis, and the slow progressive invasion of the disease to the approximal and distant teeth from the teeth first involved by the disease.

Differential Diagnosis.—This variety is differentiated from the *Diabetic Variety* by the character of the onset, the age, and the color of the gum. In this variety tartar is generally present, while in the diabetic variety it may or may not be present. The tartar is as a rule very hard, and is firmly attached to the root of the tooth, while in the diabetic variety the tartar is soft and does not adhere firmly to the root of the tooth. It is differentiated from the *Infective Variety* by the history, the character of

the onset, the invasion, and the color of the gum; from the *Gastro-intestinal Toxemic Variety* by the character of the onset and the physical condition of the patient; from the *Pre-senile Variety* by the history, the color and texture of the gum, and the recession of the gum at the necks of the teeth involved; from the *Senile Variety* by the gradual recession of the gum around all of the remaining teeth; from the *Exciting Varieties* by the evidence which they leave on the tissue.

Symptomatology.—The onset of the interstitial variety is insidious, the patient stating that a positive date of the first manifestation of the disease cannot be recalled. It is found that the gum and teeth involved have for some time been slightly painful, but at the time of calling on the dentist this painfulness is much increased. This is probably due to an exacerbation and if the patient is questioned it is learned that in the beginning of the disease these attacks were very mild, but that they have gradually increased as the condition became worse.

The invasion like the onset is a very gradual process. It may or may not attack the gum and tooth which is adjacent to the tooth affected by this disease. It may attack a tooth on the

opposite side of the mouth, either in the lower or the upper jaw. The invasion of the disease in all probability is by way of the blood stream or by way of the canceled portion of the alveolar process after the establishment of the disease. The course of the disease is very slow, involving one tooth and then another until all of the teeth are more or less affected.

Prognosis.—The prognosis is dependent on the duration of the existence of the disease and the severity of the nephritis. If the physical condition of the patient is fairly good a better prognosis can be offered than if it is poor.

Treatment.—The treatment of the gum and mouth should be rigid and thorough prophylaxis. The systemic condition of the patient should be looked after by the family physician. The physician should also prescribe such treatment which, when given with the AUTOGENOUS BACTERIAL VACCINES, will assist them in raising the immunity of the patient.

INFECTIVE VARIETY.

Etiology.—The infective variety may occur at any age after puberty. It is not selective as to sexes, social conditions or occupation. Previous diseases have much to do with the pro-

duction of this variety, especially if they are of that type which is debilitating, for by this action they lower the immunity of the sufferer and thus subject the gum, peridental membrane and alveolus of the patient to the action of micro-organisms and their products.

The exciting causes, like the predisposing, in all probability are factors of great importance. Trauma of the gum is produced by the use of a tooth-pick, a pin, the blade of a knife, or blunt instrument, or by a blow upon the tooth of sufficient severity to loosen it, or upon the gum tissue producing contusion. The chemical irritants by their action upon the gum tissue produce an irritation followed by swelling which forms a pocket at the gingival margin, offering an excellent place for the growth of bacteria. Mechanical irritants; namely, ill-fitting crowns and bridges, act as irritants to the gum tissue. The thermal irritants, especially hot tea or coffee and hot food, are capable of producing sufficient trauma and in many instances a destruction of the gum tissue around a tooth or teeth ensues. If this occurs inflammation of the gum results and a focus of infection is established. The local immunity is impaired and the process of destruction continues until the

tissues re-establish an immunity capable of protecting the remaining tissue. The bacteriological irritants are of great importance, for by their presence they bring about such reactions on the tissues in which they are present that the function of the tissues are impaired. As a result of this impairment the resistance of the tissue is lowered, after which not only does this reaction continue, but the bacteria grow more abundantly and the adjacent tissues are attacked, the disease soon involving the gum and the adjacent teeth of the upper and the lower jaw. The chronic variety is a progressive stage of the acute variety.

Pathology.—The acute infective variety is characterized by localized inflammation of the gum at the neck of the tooth; or this inflammatory process may involve the gum tissue of all the teeth and the mucous membrane of the mouth. The swollen gum varies in color from a light to a dark bluish-red and is firm on palpation. The swelling causes the gum to loosen at the gingival margin and a pocket is established, which, if massaged, brings to the gingival margin a small bead of exudate that is whitish in color and adheres firmly to the gum. On microscopic examination it is found to be com-

posed of pus cells, epithelial cells, bacteria, of one predominant variety, phagocytes and granular material. The roots of the teeth involved by the infection are denuded of the gum and the peridental membrane, which is variable in amount. A continuation of the disease is characterized by destruction of the alveolus and a recession of the gum below the focus of the infection. An examination of the root reveals no deposit, and its surface is quite smooth.

In the chronic variety the gum is not as badly swollen as in the acute and on palpation feels quite spongy. The tinge of the gum is a deeper blue than that observed in the acute variety. The pus pocket is greater in extent and on gentle massage there exudes at the gum margin a variable amount of exudate which varies in color from a white to a creamy yellow. The exposed roots of the teeth show in this variety a deposit variable in amount and density. The color of this deposit is a dark reddish-brown. It adheres to the root of the tooth very tenaciously.

Bacteriology.—In the infective variety the color of the gum around the teeth involved varies from a light to a dark bluish-red in contrast to the normal pink. At first there is a feel-

ing of irritation of the gum, which gradually progresses until the gums around the diseased teeth become painful and the teeth involved become somewhat loose and slightly elongated. At variable times there are exacerbations, the onset of which may or may not be ushered in by a feeling of malaise and headache. These symptoms are soon afterward followed by an inflammation of the gum and the peridental membrane, producing a very uncomfortable feeling of the teeth if the disease is well advanced. The duration of the attack varies from two to five days, after which the gum and teeth rapidly return to an approximately normal state, and again feel quite comfortable.

The chronic infective variety follows the acute and is an advanced stage of it. It is characterized by a constant inflammation of the gum around the affected teeth. The swelling is slight and the feeling of irritation of the gum is constantly present. The teeth are variably loosened. The gum around the teeth feels spongy to the touch. The color is a dark reddish-blue in contrast to the normal pink. It is separated from that portion of the root of the tooth over which it lies.

Differential Diagnosis.—The acute infective

variety is differentiated from the *Diabetic Variety* by the color of the gum, which in the diabetic is a beefy-red while in this variety it varies in color from a light to a dark bluish-red. It is differentiated from the *Interstitial Nephritic Variety* by the age which is generally after the fortieth year, while in this variety it generally occurs at any time after eruption of the permanent teeth. In the interstitial nephritic variety the recession of the gum is a gradual process, while in the acute infective variety it is a rapid process. At no time is the amount of swelling as great in the interstitial nephritic as is observed in this variety. The gum is slightly painful on pressure in the interstitial nephritic, while in the acute infective variety it is exceedingly painful on the slightest pressure. This variety is differentiated from the *Pre-senile Variety* by the age, which is between 25 to 40 years. The pre-senile variety is a slow progressive process destroying the gum, peridental membrane and the alveolar process, which, if accompanied by suppuration, greatly increases the destruction of the tissues on which the position tooth is dependent. The gum tissue in the pre-senile variety is firm and hard, has a normal pink color, and is not painful on

pressure. In the infective variety, whether acute or chronic, the gum is swollen and painful on pressure. In the pre-senile variety the exposed portion of the root presents a deposit which varies in color from a light yellow to a reddish-brown and in hardness from a soft chalky to a flinty consistency. In the *Senile Variety* there is a general shrinkage of the gum around all of the remaining teeth. The gum is firm to the touch, normal in color, and on massage, a small amount of exudate may or may not appear at the gingival margin. If the deposit is present it is yellow in color, and of a chalky consistency. There is a general loosening of all of the remaining teeth. The *Gastro-intestinal Toxemic Variety* is differentiated from the acute and chronic infective varieties by exacerbations which are characterized by headache, nausea, and intestinal disturbances. These are followed by a marked feeling of irritation of the gum and the peridental membrane, the teeth become very sensitive on occlusion and are slightly loosened. The *Exciting Varieties* are differentiated from the infective varieties by such evidence which presents itself as a result of trauma, chemical, mechanical, thermal, and bacteriological irritants.

Symptomatology.—The acute variety of this disease is characterized by a sudden feeling of irritation of the gum at the necks of the teeth affected. This feeling is soon after followed by tenderness and swelling. The gum around the teeth involved varies in color from a light to a dark bluish-red and is firm to the touch. At the neck of the tooth the gum retracts from it and forms a pocket. The teeth as a rule involved by the disease are loose, feel elongated to the patient, and are painful when brought into occlusion.

The chronic variety is a continuation of the acute stage and is characterized by an invasion of the disease to many of the teeth of the upper and the lower jaw. The gum in this stage is of a deeper blue color than observed in the acute stage, but is not as badly inflamed and feels spongy to the touch. The pockets are larger and the exposed portion of the roots show a deposit. The teeth are loose and are quite painful when brought into occlusion.

Prognosis.—The prognosis of the infective variety is as a rule very good.

Treatment.—The hygiene of the mouth is first in importance in the treatment of this variety and should consist of a good antiseptic

mouth wash which is astringent. The character of the diet should be determined and if found faulty should be corrected by the physician. If the patient is poorly nourished such systemic treatment should be instituted as will improve the general health. The immunity of the patient should be raised by drugs and AUTOGENOUS BACTERIAL VACCINES.

GASTRO-INTESTINAL TOXEMIC VARIETY.

Etiology.—This variety of pyorrhea may appear at any time after the eruption of the permanent teeth. The sexes are equally affected. It is found in the middle and wealthy classes, more often in the latter. It is most often found among extravagant livers who lead sedentary lives. It may, however, occur in the mouth of any one suffering with a gastro-intestinal toxema. Previous diseases which have the ability to leave behind a diminished functioning gastro-intestinal apparatus and diminished function of the organs of elimination are of importance in this variety.

Pathology.—The gum and the mucous membrane of the mouth are swollen and painful during an exacerbation. The gum at the necks of the teeth varies in color from a very bright to a

very dark red as compared to the normal pink color. It is very firm on pressure and greatly increased in size as compared to the normal gum at this point. The swelling of the gum causes it to retract at this point and by so doing pockets are established. The exudates found in the pockets are rich in substances in which bacteria grow readily. The depth of the pockets depends on the previous number of attacks and on the extent of the infection which accompanied them. If the disease is of some standing, gentle massage of the pockets will bring to the margin an exudate which varies in color from a pale white to a yellow, and from a thin watery to a creamy consistency. When examined under the microscope it shows pus cells, fibrinous material, granular debris, and a variety of bacteria. The teeth affected by the exacerbation become very loose and are painful on occlusion. Sordes are observed on the teeth, the tongue is coated, and the breath as a rule is foul smelling.

Bacteriology.—The bacteria found in this variety are the *staphylococcus pyogenes albus*, *aureus*, and *fetidus* (especially the fetidis) *diplococci*, *spirochæta refringens*, and *saprophytes*.

Diagnosis.—The diagnosis of this variety is made on the history of the onset of the exacerbation, the wide-spread inflammation of the gum and the mucous membrane, the swelling and the color of the gum, and symptomatology.

Differential Diagnosis.—This variety is differentiated from the *Diabetic Variety* by the color of the gum which in the diabetic variety is a beefy red. In the diabetic variety there is a history of diabetes and the teeth affected are fewer in number. It is differentiated from the *Interstitial Nephritic Variety* by the history of the interstitial nephritis, the presence of albumin in the urine, the color of the gum, and the gum is not as greatly swollen; from the *Pre-senile Variety* by the gradual recession of the gum. The gum is not painful to pressure in the pre-senile variety. From the *Acute and Chronic Infective Varieties* it is differentiated by the history of the onset of the disease. The gum in the infective variety is affected quite extensively and the consistency of the gum in the chronic variety is different from that found in this variety. It is differentiated from the *Senile Variety* by the history, the great amount of recession of the gum, the constant looseness of the teeth, the absence of teeth, and the age of the patient.

Symptomatology.—The onset of this variety is usually sudden and is characterized by a feeling of soreness and puffiness of the gum. After the onset the condition continues to become worse and after 24 hours the gum around the teeth becomes very painful on pressure and the teeth variably loosened and feel elongated to the patient. The gum bleeds readily when brushed but after the bleeding feels greatly relieved. In some instances the gum at the necks of the teeth becomes so loose that in the act of mastication of the soft foods which the patient eats, particles of the food crowd into the pockets and greatly irritate it, causing pain. The patient complains of a headache and nausea which is variable in intensity, does not care for food and feels best when lying down. The above symptoms are mild in character in the beginning of the disease, but as the disease progresses become worse at each exacerbation, and at the time of the visit to the dentist are severe in character. In some cases swelling is located at a considerable distance downward from the gum margin. Slight pressure over this point causes the patient to wince and object to repetition of the procedure. Pus appears if this point is lanced. The pain is, as a rule,

instantly relieved after it is opened. The duration of the exacerbations varies from three to five days, after which the tenderness of the gum and sensitiveness of the teeth gradually subside. The inflammation disappears and the gum, teeth and mucous membrane gradually return to a stage of quiet, during which they feel quite comfortable to the patient.

Prognosis.—The prognosis of this variety is good.

Treatment.—The treatment should be rigid prophylaxis. An antiseptic mouth-wash is necessary. The diet is of paramount importance as it is in all probability the cause of the disease. A patient suffering from this variety is usually very indiscriminate and as a result is suffering from gastro-intestinal toxema, which greatly impairs the organs of elimination. After a diagnosis has been made the patient is sent to the family physician with a note stating the findings and advising that he be treated for a gastro-intestinal toxema. The AUTOGENOUS BACTERIAL VACCINES are of great value when assisted by the administration of drugs and instrumentation of the affected teeth.

PRE-SENILE VARIETY.

Etiology.—This variety of pyorrhea manifests itself between the ages of 25 and 40 years of age. It is observed in women more often than in men. Its occurrence is no doubt equal in the sexes, but the reason more women are seen suffering from this variety is because they are more particular about their teeth.

The social conditions have a considerable influence in the production of this disease. Rich foods and alcohol, when taken in excess, have a marked influence in its production, hence this variety is not one ordinarily observed among the lower classes, but among the middle class and the rich.

The exciting causes; namely, trauma, chemical, mechanical, thermal, and bacteriological irritants, when superimposed upon the condition in its beginning have no doubt much to do with the destruction of the gum tissue around the teeth.

Pathology.—The pre-senile variety shows a variable recession of the gum at the necks of the teeth. The gum on examination feels firm to the touch and on vigorous massage is slightly painful. The gum does not bleed readily and

an exudate is, as a rule, absent. If present it is very small in amount, its consistency is watery and the color white. The shrinkage of the gum is probably preceded by a destructive process of the alveolus and the peridental membrane. This process may be local or it may be general around the root of a tooth or the roots of molars. This variety is in all likelihood one of impaired nutrition of the gums, peridental membrane and the alveolar process. The impaired function is accompanied or followed by a lowered immunity, if the degenerating process does not right itself within certain limits by the regeneration of the lost tissues or by their replacement with connective tissue. The degenerated tissues are partially or totally destroyed by nature, by absorption, or by the action of such irritants as have the ability to destroy tissues with which they come in contact; namely, bacteria, their products, and such chemical irritants as are present locally or contained in the saliva. The roots of the teeth affected may or may not show a deposit, which, if present, varies in color from a light yellow to a reddish-brown, and in hardness from a chalky to a flinty consistency. Many times when the deposit is present, it acts as an irritant fol-

lowed by inflammation of the tooth and forms a pocket in which bacteria grow readily. If the inflammation does not subside the bacteria and their products contained in the pocket bring about, sooner or later, a destruction of the gum in which the pocket is located, and sometimes destruction of the peridental membrane and the alveolus. Many times the alveolus and the peridental membrane of one tooth are attacked by the disease; in which event it is self-limited, and after their destruction the gum gradually shrinks until it is below the point of their destruction. After which no further destruction of the gum, peridental membrane and alveolus occurs.

Diagnosis.—The diagnosis of the pre-senile variety is made on the age which varies from 25 to 40 years. There is as a rule a recession of the gum from around the necks of the teeth. If the gum is massaged it does not bleed readily and has a normal feeling on palpation. The color of the gum is a normal pink. If, however, the condition is complicated by a pocket, the gum is inflamed and a variable amount of pus appears on massage.

Differential Diagnosis.—This variety is differentiated from the *Diabetic* by the color of

the gum. In the diabetic the gum on massage bleeds readily, while in this variety it does not. In this variety the gum gradually recedes from around the necks of the teeth, while in the diabetic it does not. Tartar may or may not be present, while in the diabetic it may or may not be present. This variety is differentiated from the *Interstitial Nephritic Variety* by the age of the patient, the history of a nephritis, the presence of variable sized pockets around the roots of the teeth affected, and by the color of the gum; from the *Gastro-intestinal Toxemic Variety* by the history and the character of the onset; from the *Senile Variety* by the age, the history, and the evidence of lost teeth and loose teeth with a general shrinking of the gum tissue around the remaining teeth.

Symptomatology.—The onset of this variety is insidious. The patient does not really know when the disease first commenced, but states that for a number of years at varying intervals there have been periods during which the gum around the tooth or teeth affected has been slightly swollen and tender. The disease may be confined to one molar or incisor, the teeth on either side of which are not involved. The mildness at the onset and during the progress of

the disease, readily explains why the patient did not observe the condition until the teeth adjacent to the tooth first affected by the disease commenced to undergo the same process—that of a slow progressive destruction of the gum, peridental membrane, and the alveolar process. After an indefinite time this is followed by looseness of the tooth or teeth which greatly inconveniences the patient in mastication and articulation, with a deformity of the position of the teeth and the gum around the necks of the affected teeth.

Prognosis.—The prognosis is bad. If this variety of pyorrhea is complicated by an infection the prognosis is good as far as the infection is concerned, but not as to a cure of the disease.

Treatment.—The treatment should be rigid prophylaxis, and the patient given a mouth wash, which is astringent and stimulating to the gums. The diet should be corrected by the family physician, if found faulty. The general treatment should be systemic and local. If the disease is accompanied by pus an AUTOGENOUS BACTERIAL VACCINE should be administered. Massage of the gum and instrumentation should be instituted as indicated.

SENILE VARIETY.

Incidence. This variety occurs after 50 years of age. It is found equally among the sexes. Social conditions and occupation are of no importance.

The exciting causes have considerable influence, though, of small probability, being the most important. The area of the shrunken gum produces a form of lowered resistance, and as a result, the pathogenic bacteria of the mouth have an increased opportunity for development. A decrease in the vitality and a focus of infection develop within the margin of the gum, periodontal membrane and the alveolar process. The chemical factors, such as the acids, have the ability to decrease the resistance of the gum with which they come in contact, and also lower the resistance of the gum. The mechanical irritants, such as filling plates, bridges and crowns, the friction or irritation of the gum and a lowered immunity of the gum with which they come in contact. The thermal irritants by their action on the gum bring about a lowered resistance which may or may not terminate in the loss of the gum tissue affected by them. If the pathogenic bacteria of the mouth find a

point in the gum tissue around a tooth which offers them protection they soon commence to multiply and by their growth the gum is destroyed at this point.

Pathology.—The onset of this variety is insidious and presents gum tissue that is low in resistance. The pockets if present are variable in size and are probably the result of one of the exciting causes. The color of the gum varies from a normal pink to a deep red. The consistency of the gum varies from a normal firmness to variable degrees of softness, when palpated. The diseased gum may or may not be tender on pressure. Massage of the gum, over a pocket brings to the gingival margin an exudate which on microscopic examination is found to be composed of pus cells, fibrin, and a variety of bacteria.

Bacteriology.—The most common organism associated with this variety is the *staphylococcus pyogenes fetidis*. The *staphylococcus pyogenes albus*, various *diplococci*, *spirochæta refringens* and *leptothrix buccalis* are also found.

Diagnosis.—The diagnosis of the senile variety is made on the age, the presence of loose teeth, the recession of the gum, the presence of

calcarious deposits on the exposed portions of the roots of the teeth affected, under the gingival margin, and some times at a considerable distance from the necks of the teeth under the gum. There may or may not be pus pockets present.

Differential Diagnosis.—The only variety that this is likely to be confused with is the *Pre-senile Variety*. In the pre-senile variety there are occasional mild exacerbations, during which the gums and teeth are affected. The patient is younger than in the senile variety. In the pre-senile all the teeth as a rule are present and are seldom loose.

Symptomatology.—The senile variety is found in the mouths of patients past 50 years of age. Its onset is insidious. The general health of the patient as a rule is good, the only complaint being that the remaining teeth, because of the looseness, cause the patient considerable inconvenience. The teeth may or may not be painful on occlusion. There may or may not be pus present around the teeth.

Prognosis.—The prognosis is bad. If it is complicated by an infection the prognosis is good as far as the infection is concerned, but not as a cure of the disease.

Treatment.—A stimulating antiseptic mouth wash should be used three times a day, and the teeth brushed not less than twice a day—morning and night. Any defects in the diet of the patient should be corrected and a diet prescribed by the family physician of such a character as will improve the physical condition. The medicinal treatment should be such as will increase the system physiologically and raise the general immunity of the patient. The AUTOGENOUS BACTERIAL VACCINES when given with the above described treatment offer good results as far as the infection is concerned, but do not cure the disease. Instrumentation by the dentist is a valuable adjunct in the treatment of this variety of pyorrhea.

VARIETY RESULTING FROM TRAUMA.

Etiology.—This variety may occur at any age in either sex. The social conditions and occupations are of no consequence. The trauma may be the result of instruments used by the over-eager dentist, heroic tooth brushing, the tooth pick and match-chewing habit, excessive tooth picking after meals, a blow which will loosen the tooth in its socket, and very hard brittle food substances which cut the gum at the gingival margin during mastication. Any

one of these factors occurring in the mouth of a patient with a local lowered immunity with the ever present pathogenic bacteria can bring about a process of suppuration which can result in a destruction of the gum, peridental membrane, and alveolus. The tooth or teeth affected become so loose that they cause the patient great inconvenience.

Pathology.—The onset of the disease is sudden and the tissues surrounding the area of trauma are markedly inflamed and painful on pressure. If infected, slight massage causes a considerable amount of pus to appear at the gingival margin. As a rule the disease is localized to one tooth. However a very extensive process may be observed if it is neglected by the patient. In the later stage of the disease the gum is a very bright red in contrast to the normal pink color. There is marked swelling and tenderness, and the gum is very tense and hard. The entire mucous membrane of the mouth may be affected with a dribbling of saliva from the corners of the mouth. The breath is fetid. The teeth may feel elongated and are painful on occlusion. Very little tartar is observed in this variety.

Bacteriology.—Any of the pathogenic organisms of the mouth may be present.

Diagnosis.—The diagnosis is made on the history of an injury.

Differential Diagnosis.—This variety closely resembles *Vincent's angina*, and is differentiated from it by a microscopic examination which shows the spirillum of Vincent and fusiform organisms.

Symptomatology.—The patient states that while masticating food or after using a tooth pick or after the heroic use of a tooth brush, the gum overlying a tooth was slightly injured, and after twenty-four hours the gum felt swollen, was tender to the touch, and bled readily when massaged or when the teeth were picked with a tooth pick. From the beginning of the injury the condition gradually became worse and as a result of the inconvenience of the gum the patient calls upon the dentist.

Prognosis.—The prognosis in this variety as to a cure is good.

Treatment.—The hygienic treatment should consist of an antiseptic and astringent mouth wash and the application of a cold compress to reduce the inflammation. The diet should be corrected if found faulty. If on examination the patient is found to be in poor health systemic treatment should be instituted by the

family physician and an AUTOGENOUS BACTERIAL VACCINE made if a process of suppuration is present. No instrumentation should be done until after the patient has been treated systematically and with the vaccines.

VARIETY RESULTING FROM CHEMICAL IRRITANTS.

Etiology.—This variety may occur at any age, or in either sex. Social conditions and occupation are of no consequence. Any disease of the body which impairs the normal physiological processes that increase or decrease the secretion and elimination of the normal acids, has much to do with the production of this variety, for by the presence of these products in the body tissues the normal resistance of the tissue is lowered and as a result thereof the natural barriers of defense are impaired and a focus of suppuration is easily established. The inorganic acids when coming in contact with the tissues of the mouth, by their escharotic action have the ability to bring about a lowered resistance and thus subject the tissues to the invasion of pathogenic bacteria with destruction of them in variable amount.

The disease, when the result of an inorganic

acid or escharotic, leaves behind such evidence as is easily identified, namely a white patch which is variable in size depending on the amount and extent of the chemical irritant which came in contact with the tissue.

Pathology.—The gum at the point of contact with the acid is white in color, may or may not be swollen, and the margin of the patch is a bright red and somewhat painful. On removing the white film of dead mucous membrane a raw bleeding surface is exposed which is very tender to the touch. In the presence of an excessive acid saliva, the gum around all the teeth shows marked irritation characterized by a bright red color, swelling, tenderness, and on pressure, marked sensitiveness of the gum at the gingival margin. If tartar is present it is generally at the gingival margin varying in color from pale yellow to a deep yellow and from a soft chalky to a hard consistency.

Bacteriology.—The bacteria present in this variety may be any of the pathogenic bacteria found in the mouth.

Diagnosis.—The diagnosis is made on the history and the presence of the white eschar, which, when removed, leaves a raw bleeding surface or an acid saliva.

Differential Diagnosis.—This variety is dif-

ferentiated from *Vincent's angina* by the presence of the spirillum of Vincent and fusiforms, and from *Lues* by the presence of the spirochæta pallada.

Symptomatology.—The onset is sudden with the following symptoms; soreness of the gum at the point with which they come in contact with the acid, inflammation of the gum around the tooth or teeth affected by contact with the acid, or by the presence of widespread inflammation resulting from an acid saliva. These inconveniences prevent proper mastication of the food and brushing of the teeth.

Treatment.—The treatment must be of such a character as will be soothing to the gums and antiseptic. If the mouth and gums are badly burned such diet should be recommended as will offer least irritation. It is best to have the family physician prescribe the diet and he should also look after the general treatment if the patient is not in good health. If an infection is present it should be treated with iodine, and if the infection does respond to the iodine an AUTOGENOUS BACTERIAL VACCINE should be made.

VARIETY RESULTING FROM MECHANICAL
IRRITANTS.

Etiology.—This variety may occur in either sex at any age; social conditions and occupation being of no consequence.

Pathology.—The gum and teeth are markedly inflamed, tender to the touch and swollen. The color is a deep red in contrast to the normal pink color. Tartar may or may not be present on the exposed portion of the tooth or teeth affected, but if present it varies in color from a pale to a deep yellow and from a soft chalky to a hard consistency. As a rule the gum is shrunken a great deal from around the necks of the teeth, and the teeth affected are quite loose.

Bacteriology.—The bacteriology varies. In one case there is one variety of organism, in the next case another variety predominates.

Diagnosis.—The diagnosis of the mechanical variety is very easy, as the irritant can be found on examination of the gum. It will be noticed that a bridge or plate produces the pressure that acts as the irritant.

Differential Diagnosis.—Is made on the presence of a mechanical irritant.

Prognosis.—Good.

Symptomatology.—The onset of this variety is slow. The patient complains of soreness of the gum around a tooth or teeth which are the abutments of a bridge, or of the teeth with which the plate comes in contact. The soreness at first is slight, and as the bridge or plate is not suspected to be the cause it is not discarded. The longer it is worn the worse the condition becomes. Eventually the gums swell and if the plate or bridge is taken out of the mouth it causes great pain when replaced. On examination the plate is found to be ill-fitting and at the point of pressure swelling occurs. When massaged pus exudes from around the gingival margin of the teeth affected.

Treatment.—The patient should be given a mouth wash which is astringent and antiseptic. The tooth or teeth affected in many instances are very loose and should be extracted. If the diet is incorrect it must be remedied by the family physician. If the patient is in poor health the general treatment should be of such a character as will build him up physically. If pus is present an AUTOGENOUS BACTERIAL VACCINE should be used in conjunction with the drugs given.

VARIETY RESULTING FROM THERMAL
IRRITANTS

Etiology.—This may occur at any age. Age, sex, social conditions and occupation are of little importance.

Pathology.—The onset of this variety is sudden. The gum is a dark red color and is highly inflamed and painful. Slightest pressure at the point of injury causes a thin exudate to appear at the gum margin. The gum may be soft or firm on pressure. The injury may be localized or wide-spread. The entire mucous membrane of the mouth is at this time affected.

Bacteriology.—If the point of injury becomes infected a variety of organisms may be found present in the early stages, but if the disease is one of long standing one variety predominates.

Diagnosis.—The diagnosis is made on the history of a burn resulting from very hot food or drink.

Differential Diagnosis.—This variety is differentiated from the other varieties by the color and extreme painfulness of the gum, and the history.

Symptomatology.—The onset of the thermal variety is sudden and progress is quite rapid.

As a rule the disease has reached the maximum of development at the point of injury after 24 hours. If the injury is one of considerable extent the patient is greatly inconvenienced. The injured gum has at first a numb feeling, but after a few hours this feeling subsides and the gum becomes very tender. If localized and uninfected the gum is inflamed and of a dark red color in contrast to the normal pink of the adjacent gum.

Prognosis.—Good.

Treatment.—The treatment should consist of a bland antiseptic mouth wash. The general treatment should be of such a character as will build up the patient physically. An AUTOGENOUS BACTERIAL VACCINE should be administered if the injured gum becomes infected.

VARIETY RESULTING FROM BACTERIOLOGICAL IRRITANTS.

Etiology.—The bacteriological irritants may produce pyorrhea at any age. Sex, social conditions and occupation are of little importance.

Pathology.—The pathology in this variety presents the gum in a stage of inflammation, and tenderness on slightest palpation. The color of the gum is a turgid red, and on

slight massage bleeds readily. As a rule the condition is not confined to one tooth, but many teeth are affected and in some instances all of the teeth of the upper or lower jaw. An examination of the exudate taken from the gum around the affected tooth shows that it is composed of epithelium, pus cells, and a variety of bacteria, with one variety in predominance, generally the *staphylococcus fetidis*.

Bacteriology.—The bacteria observed in a smear of this variety are the *staphylococci*, *streptococci*, *diplococci*, *leptothrix buccalis*, and the *spirochæta refringens*.

Diagnosis.—The diagnosis is made on the wide turgescence of the gum at the gingival margin, the presence of pus around the teeth, and the slow onset and invasion of the disease which affects one tooth after another.

Differential Diagnosis.—It is differentiated from the other varieties by the turgescence of the gums, the gradual invasion of the approximate teeth, and the extreme tenderness of the gums.

Symptomatology.—The onset is very slow, the patient stating that the exact time of commencement of the disease is not known. At first there is a feeling of irritation of the gum at the

necks of the teeth, later it becomes a little swollen and somewhat tender. This process continues and after a time the patient, having failed to relieve this condition, calls on the dentist stating that the gum around the teeth is exceedingly tender to the touch, that food cannot be masticated, and that the use of the tooth-brush is impossible.

Prognosis.—Good.

Treatment.—The treatment is dependent on the absolute cleanliness of the mouth and teeth. An astringent, antiseptic mouth wash is of first importance and should be used every two hours at the beginning of the treatment. The diet should consist of wholesome food which is not hard to masticate and not irritating to the tissues of the mouth. It is best to refer the patient to the family physician for the diet. The general treatment of the patient, if not in good health, should also be attended to, and should be of such a character which, when given in conjunction with the AUTOGENOUS BACTERIAL VACCINES, will assist in raising the immunity of the patient.

CHAPTER II.

Technique for Making a Blood Smear.

The technique for making a blood smear for a differential blood count is difficult for the beginner, but with a little practice soon becomes very easy.

The points commonly selected for this purpose are the lobe of the ear and the root of the nail of a finger. The point selected should be washed with a piece of cotton dipped in a 50 per cent solution of alcohol. After a few minutes the excess of alcohol is wiped off with a piece of sterile cotton. If the lobe of the ear is selected, it is grasped firmly between the thumb and the index finger, care being taken not to touch that portion from which the blood is to be taken. A small bistoury or hagadorn needle is used to make the puncture in the sterile portion projecting between the thumb and index finger. The first drop appearing at the point of puncture is removed with a piece of sterile cotton. A small drop is then allowed to accumulate, which is brought in contact with a clean slide. This

slide is then placed on a solid place, being held firmly by the index finger and thumb of the left hand. A clean slide is held between the index finger and the thumb of the right hand. The edge of this slide is brought in contact with the droplet of blood. By a forward and backward

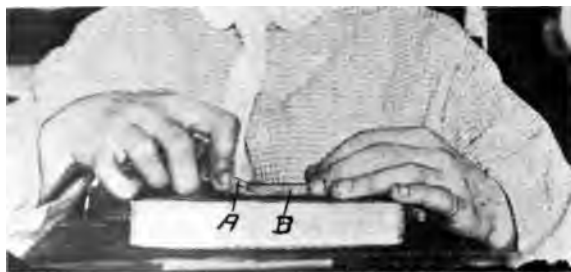


Fig. I.—Position for making a blood smear.

motion of this slide the blood is equally distributed between the edge of this slide and the surface of the slide held by the left hand, on which the permanent blood smear is to be made. (See Fig. I.)

TECHNIQUE FOR STAINING SLIDE.

The smear having been made it should be dried as quickly as possible to prevent crenation of the blood corpuscles. The smear is then stained with Wright's stain, the slide placed on

a staining pot and about 3 cubic centimeters of the stain added to the smear. This is allowed to remain on the slide from one to one-and-a-half minutes and distilled water is added. This distilled water is poured off, and the smear thoroughly washed with distilled water until no color comes away. The slide is then dried and ready for examination.

DIFFERENTIAL BLOOD COUNT.

By a differential blood count is meant the counting and classification of the white blood corpuscles morphologically and tinctorially, contained in the blood smear on the slide.

One hundred cells are counted and each variety is recorded as counted. This having been done, the number of cells counted after each variety is added, thus obtaining the percentage. A very convenient method which is used for this step is as follows:

Polymorphonuclear Neutraphylic		10%
Large Lymphocytes		12%
Small Lymphocytes		4%
Eosinophiles	/	1%
Transitionals	/	1%
Basket Cells	////	4%

NOTE.—This is not a complete count, but shows how the count is recorded and reckoned.

In persons affected by pyorrhea the differential blood count shows a marked reduction of the polymorphonuclear neutrophilic leucocytes, small lymphocytes, and an increase of the number of the large lymphocytes and basket cells. This condition is known hematologically as a *lymphocytosis*.

The large lymphocytes vary tinctorially from a pale blue stained nucleus to a reddish-violet stained nucleus. The cytoplasm like the nucleus is stained from a pale blue to a reddish-violet.

The blood count is a very necessary part of the technique in making a diagnosis in conjunction with the other examinations made. Therefore it should be made a rule that, in every case presented for examination and diagnosis, a differential blood count should and must be made.

TECHNIQUE FOR MAKING WRIGHT'S STAIN.

Dissolve 0.5 grams of sodium bicarbonate in 100 c.c. of distilled water. When the sodium bicarbonate is dissolved, add to this solution one gram of Grüber's methylene blue (B.X.). This solution is then placed in a steam sterilizer for one hour, the temperature of which is 100° C. It is allowed to cool, after which a solution of yellowish aqueous eosin is added—one gram

to 1,000 c.c. of distilled water. When about 500 c.c. of the eosin solution has been added, it is noted that the color of the solution has



Fig. II.—Arnold steam sterilizer. This apparatus is made throughout of copper, with double walls and doors, so that the sterilizing chamber is surrounded on all sides with a jacket of steam. An unvarying temperature of 100° C. can be indefinitely maintained in the sterilizing chamber without any attention. (*Courtesy Ernst Leitz, New York.*)

changed to a purple and the skum present has a metal sheen, also that there is commencing to appear a precipitate which is of a bluish-black

color. After the precipitate has appeared the eosin solution is added gradually, and the quantity of the precipitate noted from time to time on a piece of clean white paper. As soon as the added eosin no longer causes an increase of the precipitate, the precipitate is then separated from the filtrate by filtering. After the filtering process has been completed, the precipitate which has collected on the filter paper is allowed to dry. When a solution of the powder is desired for staining, 0.3 grams of the powder is dissolved in 100 c.c. of methyl alcohol (C.P.).

CHAPTER III.

Technique for Making Stains.

TECHNIQUE FOR STAINING A SMEAR OF BACTERIA.

The film of exudate taken from a pus pocket at the neck of the tooth with a platinum loop is smeared as thin as possible on a clean slide. The smear is then allowed to dry and after drying is fixed on the slide by passing the slide through a gas flame three or four times. The film is then covered with a methylene blue stain which is allowed to remain on the slide for one minute. The stain is poured off and the excess amount of stain is washed off with distilled water. After the slide is dry it is then ready for examination under the microscope.

When *Gram's stain* is used on the specimen the technique is as follows:

The smear is made in the same manner as described above. The specimen is covered with gentian-violet and set aside for 5 minutes. Then the gentian-violet is poured off and the specimen is covered with Gram's iodine, which is allowed to remain on the slide for 15 minutes.

The Gram's iodine is then poured off and 95 per cent alcohol is added to the specimen and the specimen washed with it until no more color comes away. The specimen is then counter-stained with Bismarck-brown for 1 to 3 minutes. After this is poured off the slide is washed and dried and is ready for examination.

TECHNIQUE FOR MAKING CARBOL GENTIAN.

To 100 c.c. of an aqueous carbolic acid solution add 30 c.c. of a saturated alcoholic solution of gentian-violet. Filter and set aside for 24 hours. The solution is then ready for use.

TECHNIQUE FOR MAKING GRAM'S IODINE SOLUTION.

Dissolve one gram of iodine and two grams of potassium iodide in 10 c.c. of 95 per cent alcohol. As soon as the iodine and the potassium iodide are dissolved, add to this solution 300 c.c. of distilled water. Set aside for 24 hours. Filter into a clean bottle and the solution is ready for use.

TECHNIQUE FOR MAKING BISMARCK-BROWN SOLUTION.

This stain is an excellent one for counter-staining bacteria by Gram's method and is made as follows:

Dissolve 0.5 grams of Bismarck-brown in 5 c.c. of 95 per cent alcohol. As soon as the powder is dissolved add to the solution 100 c.c. of a 2 per cent aqueous carbolic acid solution. This solution is set aside for 24 hours, after which it is filtered and ready for use.

TECHNIQUE FOR MAKING METHYLENE BLUE.

Dissolve 5 grams of methylene blue in 50 c.c. of 95 per cent alcohol. Set this solution aside for 2 days. To 100 c.c. of distilled water add 30 c.c. of the alcoholic solution of the methylene blue. Set aside for 24 hours, filter, and the solution is ready for use.

TECHNIQUE FOR MAKING LOEFFLER'S METHYLENE BLUE.

To 100 c.c. of a 1:10,000 solution of potassium hydroxide add 30 c.c. of an alcoholic solution of methylene blue. Set the solution aside for 24 hours and filter, after which it is ready for use.

CHAPTER IV.

Technique for Making Culture Media.

To the beginner the technique for making agar is a very hard task. The author (thanks to his teacher, Dr. M. A. Barber, formerly of the University of Kansas, who is a master in the art of making agar) was so thoroughly impressed that he wishes to do the same for the reader of this little monograph.

PREPARATION OF AGAR.

The first step is the preparation of the agar which is as follows:

The agar is broken up into small threads approximately one inch in length. 15 grams of agar prepared in this manner are placed in a flask which contains 500 c.c. of distilled water. The flask is then stoppered and set aside for 3 days.

The second step is the preparation of the meat infusion and is as follows:

One pound of lean beef is chopped up very fine and placed in a flask which contains 500 c.c.



Fig. III.—Autoclav. This apparatus is for sterilization under steam pressure. (*Courtesy Ernst Lettz, New York.*)

of distilled water. The flask containing the meat infusion is then placed in the refrigerator for 24 hours.

The next step is the autoclaving of the agar at about 12 pounds for one hour. While the agar is autoclaving, the meat is strained through a clean towel and the quantity after straining brought up to 500 c.c. Add to the meat infusion 5 grams of salt and 10 grams of peptone (Witte). These substances having been added to the meat infusion, it is placed on a hot plate and the peptone and salt are gradually dissolved. Do not allow the temperature of the meat infusion to rise above 39° C.

The agar is now removed from the autoclav and cooled to 39° C. The meat infusion is again placed on the hot plate and the temperature gradually raised to the boiling point, and at the same time the agar is added, stirring the mixture vigorously until all of the agar has been added. The mixture is then thoroughly boiled, after which it is filtered through cotton in a funnel (through which boiling water has been previously passed) into a clean flask.

As soon as all of the agar has passed through the filter two samples of 5 c.c. each are taken from the agar and are placed in a small beaker

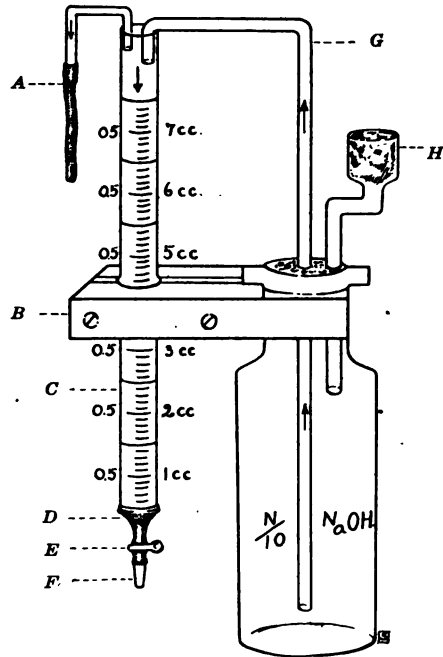


Fig. IV.—Burette-bottle containing NaOH ($\text{N}/10$), and wood holder for burette.

- A. Rubber hose for making suction.
- B. Wood clamp for holding burette.
- C. Burette.
- D. Rubber hose.
- E. Clip for controlling NaOH .
- F. Glass nozzle.
- G. Glass tube from bottle to burette.
- H. Glass chamber containing lime through which air enters bottle.

for titration. The flask of agar is again placed in a steam sterilizer for one hour. While the flask of agar is in the steam sterilizer the titration of the agar may be done.

The technique for **titration** is as follows:

To the 5 c.c. of agar placed in each beaker is added 45 c.c. of distilled water and the beaker is placed in a water bath and boiled vigorously. The object of this step is to rid the mixture of as much carbondioxide as possible. To the mixture which has been boiled is added 0.5 to 1 c.c. of a 1 per cent alcoholic solution of phenolphthalein, which is the indicator. The titration is then commenced. Before continuing this step of the technique, it will perhaps be best to describe the burette. This instrument is a long glass tube graduated into tenths of a cubic centimeter. If the substance to be titrated is suspected of containing an acid, the burette is filled with an N/10 solution of sodium hydroxide, which means that one-tenth of the sum of the atomic weight of the sodium hydroxide is added to the liter. Thus in this case the sodium hydroxide is composed of sodium, hydrogen and oxygen. The sum of the atomic weight of these substances is 40. Hence, to make a normal solution 52.92 grams of sodium hydroxide are added

to the liter, and to an N/10 solution one-tenth of the amount of the sum of the atomic weights, which is 5.292 to the liter of distilled water. This solution is then titrated against an N/10 solution of hydrochloric acid. One c.c. of the hydrochloric acid is placed in a small beaker to which distilled water is added. The solution is boiled, and 0.5 c.c. of phenolphthalein is added, which is the indicator. The NaOH solution is then allowed to slowly run into the beaker containing the acid. As soon as the first color appears a reading is made on the burette. The next step is the subtraction of this reading from the original reading, and the result should show that 1 c.c. of the NaOH will neutralize 1 c.c. of the HCl. If this end reaction occurs then the N/10 NaOH is correct. If it is short of or over this reaction more NaOH or water must be added.

For example:

First reading10.0
Second reading10.9

Subtracting

10.9

10.0

00.9

Therefore more of the NaOH would have to be added to the solution.

Again, for example, suppose agar is being titrated:

First reading10.0
Second reading11.9

Subtracting

11.9
11.0

$00.9 \times 2 = 1.8$ per cent acidity.

If a neutral solution is desired 18 c.c. of NaOH (N) is added.

After the agar has been in the sterilizer for one hour, it is removed and another titration is made to determine if the correction made is correct. If not, NaOH is again added. The agar and broth which give the best results culturally are 0.8 per cent acid. Hence, therefore add 10 c.c. of the NaOH to the agar or broth.

PREPARATION OF BROTH.

One pound of lean beef or veal is chopped very fine and placed in a flask, after which 500 c.c. of distilled water is added. The meat in-

fusion is placed in a refrigerator for 24 hours, and then strained through a clean towel. To the infusion thus obtained 5 grams of salt and 10 grams of peptone are added. The infusion is brought up to 1,000 c.c. and poured into a granite vessel and brought to 39° C., at which temperature it is held until the peptone is dissolved. As soon as the peptone is dissolved, it is boiled vigorously for 10 minutes and then filtered in the same manner as the agar.

Technique for Tubing and Sterilization of Culture Media.

Select heavy walled glass tubes, the content of which can vary depending on the quantity desired. The cotton plugs with which the tubes are stoppered should be of the best absorbent cotton. The cotton stopper of the tube is withdrawn and held between the index and second fingers of the left hand. Place in each tube the desired quantity of the culture media after which the stopper is again placed in the tube and the tube placed in a basket. The tubes having been filled are placed in the autoclav or the steam sterilizer. If placed in the steam sterilizer they are kept there for one hour. If

placed in the autoclav the pressure of the autoclav is raised to 12 pounds, after which it is allowed to cool and the tubes removed. If the steam sterilizer is used the tubes must be sterilized for 3 consecutive days, but if the autoclav is used one sterilization is sufficient. The tubes are ready for use after being sterilized.

CHAPTER V.

Bacteriology.

The following bacteria are most commonly observed in pyorrhea :

- I. Staphylococcus Pyogenes Albus.
- II. Staphylococcus Pyogenes Aureus.
- III. Staphylococcus Pyogenes Citreus.
- IV. Staphylococcus Pyogenes Fetidis.
- V. Streptococcus Pyogenes.
- VI. Bacillus Pyocyaneus.
- VII. Diplococcus Pneumonia.
- VIII. Leptothrix Buccalis.
- IX. Spirochæta Refringens.

A complete description of the above bacteria is given in the following pages :

STAPHYLOCOCCUS PYOGENES ALBUS.

This organism is non-motile, non-flagellate, and does not form spores. It liquifies gelatin, is non-chromogenic, is ærobic or facultative and anærobic. It stains readily with methylene blue and Gram's method.

This organism is variably pathogenic, for experiment has shown that when guinea-pigs or

rabbits are inoculated with a culture a localized abscess develops. But if lathal doses are injected directly into the blood-stream an occasional septicæmia develops, and when it does small abscesses are found in the capillaries and the kidneys.

Morphology.—This organism morphologically measures 0.7 microns in diameter. It is hemispherical in shape, and forms groups in an irregular manner. The most common grouping is likened to a bunch of grapes.

Isolation.—Isolation is readily made as follows:

The first step is the sterilization of the Petri dish. Before receiving the culture media the Petri dish should be placed in a hot air sterilizer, the temperature of which is gradually raised until it reaches 250 to 300 degrees C. This temperature is held for 20 to 30 minutes, after which the sterilizer is allowed to cool, and the Petri dish should be removed as soon as it can be handled. The culture media of agar-agar is then liquified and placed in the Petri dish. The culture media is inoculated as soon as it has solidified, after which the Petri dish is inverted and placed in the incubator. The second step is to place in the Petri dish 5 to 10



Fig. V.—Petri dish.



Fig. VI.—Hot air sterilizer. (*Courtesy Ernst Leitz, New York.*)

c.c. of agar or gelatin. The lid is then placed quickly over the dish and the agar or gelatin is allowed to cool. After the agar or gelatin has cooled a smear from the pus or a test tube is made by rubbing a platinum loop over the surface of the culture media. The Petri dish is then inverted and placed in the incubator. At the end of 24 hours the colonies appear on the surface of the culture media as small white points, which extend rapidly over the surface of it. In the planting of the pus or the culture from a tube a group of organisms are sometimes planted below the surface of the culture media. If this is the case, it is noted after 24 hours that at the point where this has occurred there is liquifaction, and the growth invading the culture media comes to the surface.

Growth on Agar-Agar.—On agar the organism grows along the entire line of inoculation, appearing moist on its surface and is well circumscribed. The color is white.

Growth on Potato.—The growth on potato is luxuriant. It is shiney, moist, and white in color.

Growth on Bouillon.—In bouillon the growth produces a diffuse cloudiness with a whitish sediment in the bottom of the tube.

STAPHYLOCOCCUS PYOGENES AUREUS.

This variety of staphylococcus is not widely distributed in nature. It does not live a saprophytic existence. It is found in man and the lower animals. The organism is occasionally present in the dust of houses and hospitals. Its most common habitat is on the skin and the mucous membrane of the mouth, eyes and nose of man.

Morphology.—Morphologically this organism is like the *staphylococcus pyogenes albus*.

Staining.—Stains readily by methylene blue and by Gram's method.

Isolation.—The isolation is accomplished as described for the staphylococcus albus. The colonies which appear after inoculation of a Petri dish after 36 to 48 hours are of a golden color. If any of the organisms are planted below the surface of the culture media they will liquify it.

Growth on Agar.—The growth on agar is moist, shining and circumscribed, and has a golden color.

Growth on Potato.—The growth on potato is luxuriant, is moist and shining, and has a golden color.

Growth in Bouillon.—When planted in bouillon the growth of this organism causes a diffuse cloudiness with a variable amount of precipitate in the bottom of the tube.

Growth in Milk.—If planted in milk coagulation occurs which afterwards is followed by digestion of the casein.

Pathogenesis.—The pathogenesis has been proven by experiment to be deadly. Simple subcutaneous introduction of the organism will produce an abscess which in some instances has proven fatal. The most common avenues are abrasions of the skin or mucous membrane, protected places such as the crypts of the tonsil, and folds of mucous membrane. This organism is at all times present in the mouth and is ready to commence its propagation when the resistance of the tissue is below normal.

Toxins.—The toxic substances were first noted by Leber in 1886. He observed that a culture of staphylococci, when treated with alcohol, produced a crystalline body which was soluble in alcohol and in ether, and slightly soluble in water. Leber named this substance *phlogosin*. Van Der Velde in his work found that the staphylococci possess metabolic products that are destructive to leucocytes. He

states that the action of these products inhibits the ameboid movement of the leucocytes. In addition to the inhibitory action of the leucocytes, they cause the leucocytes to become spherical in shape and to gradually lose their contents. To the substance which thus affects the leucocytes, Van Der Velde gave the name of *leucocydin*. Kraus in his work on this organism observed that the action of the products of the staphylococci were hemolytic and that by this action they destroyed red blood corpuscles. Neisser and Wechelsberg confirmed the observations of Kraus and they gave to this substance the name of *staphylosin*.

STAPHYLOCOCCUS PYOGENES CITREUS.

This variety of staphylococcus is morphologically and culturally like the two preceding varieties. It resembles the two preceding varieties so closely that it can only be differentiated from them culturally. After 24 hours this organism culturally is a rich lemon color.

STAPHYLOCOCCUS PYOGENES FETIDIS.

This organism is found almost constantly present in the mouth of man around the teeth, in the pockets around the diseased roots of the

teeth, and under the gingival margin of the gum around healthy teeth.

Morphology.—Morphologically like the other staphylococci.

Staining.—Stains readily with the anilin stains and by Gram's method.

Isolation.—Is isolated in the same manner as any of the other staphylococci.

Growth on Agar.—On agar it grows readily, and culturally looks like the *staphylococcus pyogenes albus*, but is differentiated from it by the foul odor which it produces when growing on agar.

Growth on Potato.—Grows readily on potato.

Growth in Bouillon.—Grows readily in Bouillon, producing a marked cloudiness and foul odor.

Growth in Milk.—If planted in milk this organism first produces a coagulation, which is later followed by a digestion of the casein.

Pathogenesis.—The pathogenesis is at the present being worked on by the author. At this time the findings are not clear and as a result he does not wish to commit himself.

STREPTOCOCCUS PYOGENES.

This organism is non-motile, does not possess flagella, does not form spores, will not liquify gelatin or agar, is ærobic and facultative anærobe. It is spherical in shape and is infectious for man and the lower animals. By their division threads are formed.

Morphology.—It is spherical in shape, variable in size from 0.4 to 1 micron in diameter, and is constantly present in chains or pairs.

Staining.—Stains with anilin dyes and by Gram's method.

Isolation.—The isolation is the same as described for the *staphylococcus albus*. The colonies which appear after inoculation of a Petri dish are of a yellowish color after 36 to 48 hours. The organism if planted below the surface of solid culture media does not liquify it. It can be isolated from pus by one of two methods—by the plating technique, or by inoculating a mouse or guinea-pig.

Growth on Agar.—On agar an exceedingly delicate growth develops along the line of inoculation, and is composed of very small colorless transparent colonies, which do not coalesce

Growth on Potato.—Grows poorly on potat'

Growth in Bouillon.—Grows very slowly in bouillon, and if planted in bouillon grows best if slightly neutral or acid.

Growth in Milk.—Grows quite readily in milk and digests the casein.

Growth on Blood Serum Agar.—The growth on blood serum agar resembles the growth on plain agar. This media is not affected by their growth.

Growth on Gelatin.—The colonies on gelatin are small, colorless, and translucent. Microscopically they appear irregular and granular after 24 to 48 hours, and by transmitted light have a light-yellow color.

Pathogenesis.—The virulence of this organism (according to Marmorek) can be greatly increased by rapid passage through rabbits and maintained by the use of culture media composed of three parts of human blood serum and one part of bouillon. By continuing this technique he was able to attenuate the virulence of this organism to such a degree that a one-hundred thousand millionth of one cubic centimeter when injected into the ear of a rabbit was fatal.

Toxic Products.—The toxic products of the streptococci are not well known. The action of

hypodermic injections of cultures from different sources varies greatly. Cultures which have been killed by sterilization produce a more marked reaction than does the filtrate.

BACILLUS PYOCYANEUS.

This organism is a minute slender bacillus. It is motile, flagellated, does not form spores; is chromogenic, pathogenic, ærobic, or a facultative anærobe, and liquifies agar and gelatin.

Morphology.—Morphologically it is a short, slender rod with rounded ends measuring 0.3 to 2 microns in length, often seen in chains of four to six. The only organism which this one resembles is the *bacillus fluorescens liquefaciens*.

Staining.—Stains readily with any of the anilin stains, but not by Gram's method.

Isolation.—The isolation is easily accomplished by plating the pus. The superficial colonies growing on agar or gelatin in the Petri dish are small, irregular, and greenish in color. After 24 to 48 hours there is distinct fluorescence of the culture media. When examined microscopically the colonies are found to be round, coarsely granular, with serrated filamentous border. The centers of the colonies

are distinctly green, while the borders are a pale green. As the process of liquifaction of the culture media progresses the colonies sink into it.

Growth on Agar.—The plant on agar grows readily along the line of inoculation. After 24 hours the color of the plant is a bright green and is in all likelihood dependent on a soluble pigment known as *fluorescein*, which saturates the culture media, giving it the characteristic fluorescent appearance. If the culture media is high in peptone, the color changes to a deep blue green, dark blue or a reddish-brown with the age of the culture. These characteristic changes of color are the result of another substance, *pyocyanin*.

Growth on Potato.—The growth on potato is very luxuriant and varies in color from a green to a brown.

Growth in Bouillon.—In bouillon this organism produces a diffuse cloudiness and a pellicle is observed on its surface.

Growth in Milk.—It grows readily in milk, which is first coagulated and later peptonized. The reaction of the milk a short time after inoculation becomes acid.

Pathogenesis.—This organism is found in the

sputum, and on the mucous membrane of the mouth and throat. It is markedly pathogenic for laboratory animals, producing death of the animal in from 24 hours to a week.

DIPLOCOCCUS PNEUMONIA.

This organism is oval in shape and is found in pairs. It is frequently found in chains.

Morphology.—The morphology is variable. When it is grown in bouillon there is a disposition of the organism to grow in pairs. At times they grow in chains and in the smear are difficult to differentiate from the streptococci. The capsules of the organism are more apparent when the organism is grown in broth than when grown on solid media. It varies in length from 1.5 to 2 microns in length, is non-motile, has no flagella, forms no spores, and cannot long resist unfavorable conditions.

Staining.—Stains readily with any of the anilin stains, and by Gram's method. The capsule of this organism is readily demonstrated if one mixes india ink with the smear while moist.

Isolation.—The technique for isolation (employed Kiasto) is as follows:

A fresh specimen of sputum is secured and is

washed in several changes of distilled water. The object of this step is to free the sputum as much as possible of the many varieties of organisms found in the mouth. This step having been completed, a minute portion of the specimen thus treated is transferred to a Petri dish in which blood serum agar has been placed. After 24 hours the colonies of this organism begin to appear on the culture media as small round, transparent, dew drop points, which are white in color. The colony has a dark center surrounded by a pale margin.

Growth on Agar.—Grows poorly on agar.

Growth on Blood Serum Agar.—On this media the best growth is obtained. The growth along the line of inoculation consists of small transparent colorless colonies.

Growth on One Per Cent Glycerin Agar.—On this media this organism grows excellently. The growth observed is the same as noted on the blood serum agar.

Growth on Potato.—Does not grow on potato.

Growth in Bouillon.—Grows readily in this culture media, producing cloudiness.

Growth on Alkaline Litmus Milk.—Grows readily in this media and as the growth progresses the media is acidified.

Pathogenesis.—Is deadly to laboratory animals and to man, and is present in the mouth of man practically at all times. The virulence of this organism is greatly increased by passing it rapidly through animals.

Toxic Products.—The toxic products are not well understood. They are supposed to be intracellular.

LEPTOTHRIX BUCCALIS.

This organism is non-motile, non-flagellate, does not form spores, and is not culturable.

Morphology.—Measures 0.5 microns in diameter and from 10 to 50 microns in length.

Staining.—Stains readily with any of the anilin stains and by Gram's method.

Culture Media.—The author has conducted many experiments endeavoring to grow this very common organism of the mouth, but up to the present has not succeeded.

SPIROCHÆTA REFRINGENS.

This organism is motile, does not form spores, and is not culturable at this time.

Morphology.—The spirochæta refringens measures 0.5 microns in diameter and varies in length from 30 to 40 microns.

Staining.—Stains readily with any of the anilin stains and by Gram's method.

CHAPTER VI.

Pathology.

The sections described in this chapter were cut from a specimen taken from the mouth of a man about 40 years old. The cause of death was endocarditis. An examination of the mouth a few hours after death showed an extensive pyorrhea. The lower incisors were very loose and on exploration, showed very deep pockets. Slight pressure over the pockets caused pus to appear at the gingival margin. A further examination showed the same process present around the lower and upper molars. The specimen from which the sections were cut was taken from a block of the tissue around the upper right first molar.

PREPARATION OF THE SPECIMEN FOR STUDY.

The specimen is removed *en mass* with a fine saw and fixed in Zenker's solution for 48 hours.

Formula for Zenker's solution:

Potassium bicarbonate	2.5 gms.
Sodium sulphate	1.0 gm.
Corrosive sublimate	5.0 gms.
Glacial acetic acid	5.0 c.c.
Distilled water	100 c.c.

It is then removed from the solution and washed in running water for 12 hours. After the specimen is fixed, small blocks are cut from it measuring about 2 mm. in thickness, which are placed in the decalcifying solution until the specimen becomes thoroughly decalcified.

Formula for the decalcifying solution:

Nitric acid	10.	c.c.
Phloroglucin	0.5	gms.
Distilled water	100	c.c.

The step of decalcification having been completed the specimen is transferred to a 75 per cent solution of alcohol for 24 hours; from the 75 per cent solution it is transferred to an 85 per cent solution of alcohol for 24 hours, and from the 85 per cent solution to a 95 per cent solution of alcohol for 24 hours.

Having passed the specimen through the alcohol it is transferred to ether and alcohol for 24 hours and then to thin celloidin for 24 hours. From the thin to medium celloidin for 24 hours, and from the medium to thick celloidin for 24 hours. After passing through the thick celloidin the specimen is mounted on a tile block and placed in chloroform for 24 to 48 hours, after which it is ready to be cut with the microtome.

Formula for Delafield's Hematoxylin:**Solution No. I.**

Hematoxylin Crystals	1	gm.
Saturated solution ammonia alum...	400	c.c.
Alcohol (95 per cent)	25	c.c.

First dissolve the hematoxylin in the alcohol; then add the ammonia alum solution. Place the mixture in a bottle, set it aside for a few days, filter and add.

Solution No. II.

Glycerin	100	c.c.
Alcohol (95 per cent)	100	c.c.

Stopper the bottle with a cotton plug and allow the solution to stand in the light until it becomes dark. Then filter and stopper with a tight-fitting cork. The section cut with the microtome is placed in 10 c.c. of this stain from 12 to 24 hours, after which it is placed in tap water to which has been added one drop of aque ammonia, in which it is allowed to remain until very black. It is then transferred to a solution of iron ammonium persulphate until it becomes a deep brown.

Iron ammonia persulphate	2	gms.
Distilled water	100	c.c.

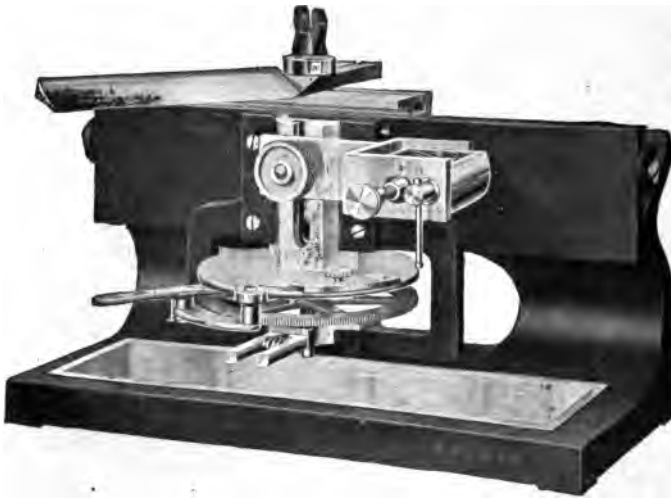


Fig. VII.—Medium Laboratory Microtome. This instrument will be found very satisfactory for general use in a laboratory, being of a suitable size, scope and stability to perform all ordinary work accurately. The feeding mechanism, while operated by hand, provides for convenient manipulation and affords a wide range of cutting thickness. It is fitted with patented split nut, having convenient handles by means of which the carriage may be brought to the starting or intermediate positions instantaneously. (*Courtesy Bausch & Lomb Opt. Co.*)

The section is next transferred to distilled water for 5 minutes; from the distilled water to 85 per cent alcohol for 5 minutes; from the 85 per cent alcohol to 95 per cent alcohol for 5 minutes; and from the 95 per cent alcohol to creasote until it is transparent.

After the section is cleared, it is removed from the creasote with the section lifter and placed upon a clean slide. Then place a drop of balsam on the section and cover it with a coverslip, gently pressing the coverslip until it is in firm contact with the section and the slide.

If a contrast stain is desired for study, excellent results are obtained with Delafield's hematoxylin and a 1 per cent solution of yellow aqueous eosin. The section is mounted on the slide with very thin celloidin, and after fixation to the slide with celloidin is stained with hematoxylin for 10 to 20 minutes. It is next immersed in warm tap water for 1 minute and then stained with the eosin solution for 2 to 4 minutes. The eosin is poured off and a 95 per cent alcohol is added to remove any excess of this stain. The section is covered with creasote and set aside until it is clear. The excess of creasote is poured off and the section is blotted with a clean blotter. A drop of balsam

is placed on the section, after which it is covered with a coverslip.

The photographs shown were stained with the hematoxylin and iron ammonium persulphate.

Longitudinal and Cross-Section of the Specimen.

Figure VIII shows a longitudinal section of the specimen and presents for study a section of the palatine root and the anterior buccal root.

The gingival margin *A* shows distinctly a separation of the gum from around the neck of the tooth. Passing down the palatine root toward the apex, an expanded area in the alveolus is observed at *B*. This is the beginning of a pocket around the root of the tooth. At *C* a smaller area of expansion is observed than at *B*. The margin between these points is irregular in outline, and the distance between the root of the tooth and the alveolus is variable. *D* is the gum tissue around the alveolus. *E* is the alveolus at the bifurcation of the roots. In the substance of the alveolus are many dark areas, which are portions of the alveolus destroyed by the disease.

The cross section (Figure IX) from which slides were made presents at *A* the alveolar process. *B* is the gum tissue, *C* the root of the tooth, and *D* the pocket described in Figure VIII.

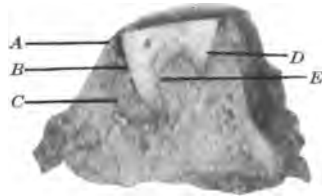


Fig. VIII.—Longitudinal section of the palatine root.

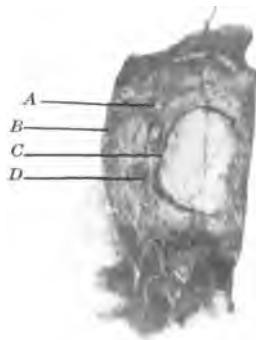


Fig. IX.—Cross-section of the palatine root.

Cross-Section of the Palatine Root and the Alveolus.

An examination around the palatine root presents a very interesting picture. *R* is the palatine root. Commence with *RC*, the root canal, and pass to the right to *D*, the cementum of the root, which is approximately normal. The peridental membrane *E* shows in its substance light areas that are foci of destruction, irregular in size and shape. At *C* the peridental membrane is greatly thickened and has invaded an area of destroyed alveolus and made itself fast. In the upper part at this point it is lighter and is composed of very fine capillaries, very fine granular debris, and a small amount of fibrinous material. This point in all probability is a regenerating area of peridental membrane. *B* shows light areas in the substance of the alveolus, irregular in shape and size. They have no definite arrangement as to their position. Some of them are filled with fine granular material; others are partially filled and still others contain nothing. Note the area which lies between the root of the tooth and the remaining alveolus, cementum, and peridental membrane for the last described va-

riety. Many times these pockets show active processes of destruction throughout the alveolus, and in some instances regeneration. *A* is a large cavity in the substance of the alveolus containing granular debris and small islands of alveolus not completely destroyed.



Fig. X.—Cross-section of the palatine root and the alveolus.

Cross-Section of the Anterior and Posterior Buccal Roots and the Alveolus.

In the peridental membrane *A* around the anterior buccal root *ABR* light areas *C-C'* can be observed, irregular in shape and size, and without any definite arrangement. Their margins are smooth and regular. *B-B'* is the alveolar process between which is passing from *A* to *A''* an extended portion of it in the substance of the alveolus. This cavity occupied by *A''* was in health alveolus. The peridental membrane is a tissue which possesses regenerating properties, and in addition thereto is constantly seeking points of attachment. Hence, the possible explanation of the invasion of the cavity by it. On further examination it is found that it again contracts itself, passing in a canal in the alveolus, and ends at *A'''*. In the substance of the alveolus at *C''* is the beginning of a process of destruction of the peridental membrane around the posterior buccal root *PBR*. At *A'* the peridental membrane of the posterior buccal root *PBR* shows no areas of the disease. *D-D'-D''* are areas of destruction of the alveolus. *D* shows a cavity that contains none of the products of destruction. *D'* is a cavity filled with

granular debris. *D''* shows an active focus of the disease and contains granular debris and fibrinous material. *E* is the cementum of the anterior and posterior buccal roots. *F* is a cavity between the anterior and posterior buccal roots and contains a small amount of degenerated alveolus and granular material.



Fig. XI.—Cross-section of the anterior and posterior buccal roots and the alveolus.

Cross-Section of the Anterior and Posterior Buccal Roots Including the Alveolus.

This section is from an area farther up on the roots than that shown in Figure XI.

The anterior buccal root *ABR* is separated more from the cementum *A* than is observed in Figure XI, and is shown in sharper contrast. It is smooth in outline and has a slight granular appearance. The periodontal membrane *B* shows in its substance many foci of the disease. They are irregular in shape, size and arrangement. *D* is a large cavity between the anterior and posterior buccal roots (*ABR* and *PBR*). *E* is a small cavity communicating with *D*. *F* is normal periodontal membrane around the posterior buccal root *PBR*. *G* is a commencing focus of the disease in the membrane around the root. *RC* is the root canal of the anterior and the posterior buccal roots.

This photograph shows that the diseased areas of the alveolus are much larger than observed in Figure XI, and they contain little if any of the products of destruction.



Fig. XII.—Cross-section of the anterior and posterior buccal roots, including the alveolus.

Cross-Section of the Palatine Root and the Alveolar Process.

A is the cementum of the root and shows no evidence of the disease. *E* is the remaining portion of the peridental membrane which contains in its substance three well-defined foci of the disease. *D* is an island of alveolus bounded on one side by the diseased peridental membrane and on the other by a cavity. *B* is a cavity, which during health was occupied by alveolus and peridental membrane. In this cavity is a considerable amount of granular debris. At *D'* is observed a very large cavity in the alveolus filled with very fine granular debris and a small amount of fibrinous material. *D''* and *D'''* show a large cavity. *D''* shows a large number of capillaries and fibrinous material. *D'''* shows fine granular debris and fibrinous material. *C-C* is alveolus not affected by the disease.

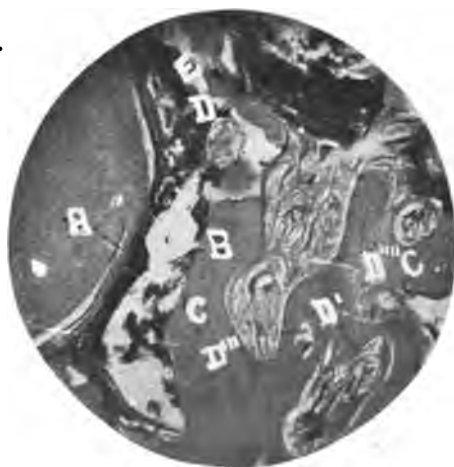


Fig. XIII.—Cross-section of the palatine root and the alveolar process.

**Cross-Section of the Anterior Buccal Root and
the Alveolus.**

In the substance of the peridental membrane *C* are many light areas, irregular in shape and variable in size. They are foci of the disease in various stages of its development. *B* is the cementum in a healthy state. *A'* shows a large cavity in the substance of the alveolus, containing granular debris and partially destroyed alveolus. *A* is the alveolus which has not been affected by the disease. *E* is a cavity filled with very fine granular debris.



Fig. XIV.—Cross-section of the anterior buccal root and the alveolus.

Cross-Section of the Palatine Root and the Alveolar Process.

The peridental membrane *A* shows foci of degeneration and marked thickening. *E* is the cementum in a healthy state. *C* is the peridental membrane of an approximate normal thickness, and contains in its substance very small foci of destruction. *B* is the alveolus not affected by the disease. *B'* is a small island of alveolus which stands out in sharp contrast to the surrounding alveolus and is in all likelihood a regenerated area of it. *D* is a canal around which are concentric whorls of the alveolus, and the author believes it is a foramen through which blood vessels passed during life. *A-A'*, the peridental membrane, has invaded a small destroyed cavity in the alveolus. The upper portion of the peridental membrane stands out in sharp contrast and is composed of very fine fibers of peridental membrane which in all probability are regenerating fibers. *B''* shows a cavity in the substance of the alveolus filled with fibrinous material and fine granular debris. Many other similar foci are noted. Some are not so well filled, while others are completely filled.



Fig. XV.—Cross-section of the palatine root and the alveolar process.

**Cross-Section of the Palatine Root Including a
Small Island of the Alveolar Process.**

A is the palatine root. *B* is the cementum and shows no evidence of the disease. *E* is the alveolar process which is not affected by the disease. *C-C'* show fibers of the periodontal membrane attached to the alveolus. *C''-C'''* is the periodontal membrane extending out into the cavity of the alveolus. *D-D'-D''* are degenerated areas in the substance of the periodontal membrane. The edges of the foci are smooth and regular and some of them contain fine granular debris, while others contain nothing. Scattered throughout the substance of the periodontal membrane are numerous round cells.



Fig. XVI.—Cross-section of the palatine root, including a small island of the alveolar process.

Cross-Section Near Anterior Buccal Root.

The alveolar process *A-A'-A''-A'''* bounds a cavity now occupied by peridental membrane, which during health was occupied by alveolus. The peridental membrane *B-B* shows in its substance light areas which are foci of the disease. At *C-C'* are very large areas composed of granular debris and the uncompleted destruction of the peridental membrane at these points. *D-D'* show many round cells scattered without arrangement in the substance of the peridental membrane.

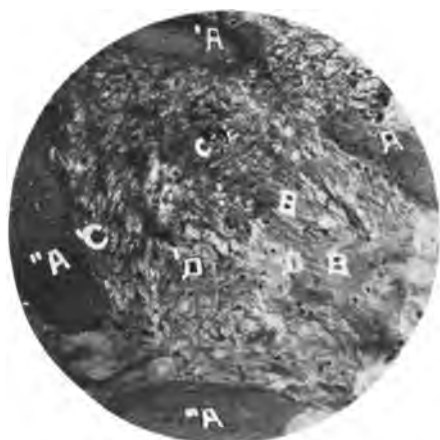


Fig. XVII.—Cross-section near anterior buccal root.

Cross-Section From Near Palatine Root.

A-A' are islands of the alveolus not affected by the disease. *B-B'-B''* show a fatty degeneration of the alveolus. *C-C'-C''-C'''* is the periodontal membrane. *D* shows round cells in the matrix of the fatty degenerated area. Round cells are also observed in the periodontal membrane and lying loose in the degenerated area.

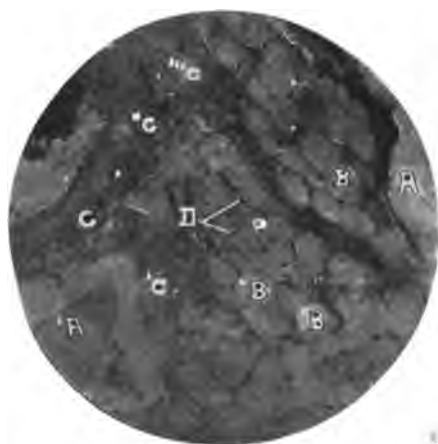


Fig. XVIII.—Cross-section from near palatine root.

**Cross-Section of the Anterior and Posterior
Buccal Roots Including the Peri-
dental Membrane.**

ABR is the anterior buccal root. *B* is the diseased peridental membrane around this root. In its substance are many light areas variable in size and shape, with smooth and regular margins. *C* is the cementum and is not affected by the disease. *A'* is an area in the peridental membrane that has not been affected by the disease. *A* is the peridental membrane of the posterior buccal root and is not affected by the disease. *C'* is the cementum of this root and shows no evidence of the disease.

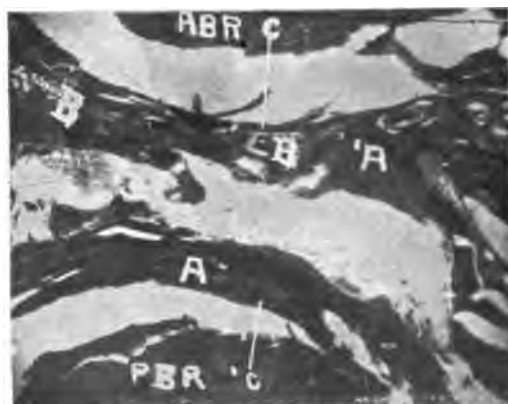


Fig. XIX.—Cross-section of the anterior and posterior buccal roots, including the periodontal membrane.

WILLIAM L. THOMAS, JR.

... in January 1964

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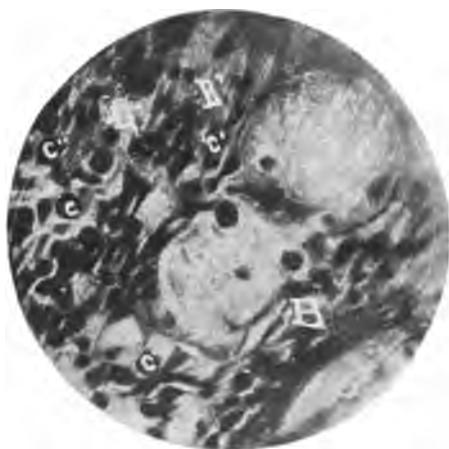


Fig. XX.—A field magnified one thousand times.

CHAPTER VII.

Technique for Making Vaccines.

The technique for making vaccines is a very simple process and offers very little difficulty to the beginner.

The first essential step is the culture media which has been described. The second is the preliminary technique for the mouth and teeth, as follows: The patient is instructed not to brush the teeth or use a mouth wash for three days before returning to the office after the first visit. At the end of this time the patient returns and plants are made from the diseased gums. After the plant has been obtained, a smear is made from the gums of all teeth affected by the disease. This having been done the gums and teeth are carefully examined and the history taken to determine which variety of the disease is present. The gums affected are wiped with a piece of sterile cotton dipped in a 50 per cent solution of alcohol. The area thus treated is protected from the lips or cheeks by a piece of sterile cotton. The platinum loop is

sterilized and placed where it will not become contaminated. The pledget of cotton is then removed from over the area treated, the fingers holding the lips or cheeks away from the gum from which the specimen is to be taken. The gum is massaged toward the gingival margin with the index finger of the right hand until the exudate appears. The handle of the platinum loop is held with the thumb and fingers of the right hand, and the loop brought in contact with the exudate. A small portion of it is



Fig. XXI.--Platinum loop.

placed on the slide, and the remaining portion is used to inoculate the culture media. The slide made is labeled with the name of the tooth from which the smear was obtained, and is set aside. Each tooth affected by the malady is treated in this manner.

One tube of agar or broth may be used for all of the teeth involved. The better plan, however, is to inoculate one with the products from the upper and another from the lower teeth. After the tubes have been inoculated they are

labeled with the patient's name and date and then placed in the incubator for 24 hours. If the case in hand is a bad one, it is best to inoculate a second set of tubes from the first set, because in all likelihood the additional quantity will be needed.

If agar is used for growing the culture it is treated as follows: Place in the tube from 5 to 10 c.c. of an 0.85 per cent solution of salt. Then take a small glass rod and carefully remove the growth from the surface of the agar. Place this emulsion in a clean test tube and seal the tube in a gas flame. The tube is thoroughly shaken for 15 to 20 minutes, the object of which is to thoroughly emulsify the bacteria. After shaking, it is best to filter the emulsion through cotton to rid it of any clumps of bacteria that are present, and thus render the standardization of the emulsion to less error as to the number of bacteria contained in a known quantity.

If broth is used a better medium of growth will be had for many bacteria. It comes nearer to the conditions of the mouth in which the organisms grow, and is probably the better method of the two. The author employs the following technique when broth is used: The

tubes having been incubated for 18 hours are removed from the incubator. They are then mixed and one-half of the broth is passed through a porcelain filter. The filtrate thus obtained is used as the diluting fluid. In addition to this, the filtrate contains the by-products of the bacteria. The author believes that the by-products are a necessary part of the vaccine.

Containers for Vaccines.

The selection of containers for the vaccine is left to the reader. The author finds the small

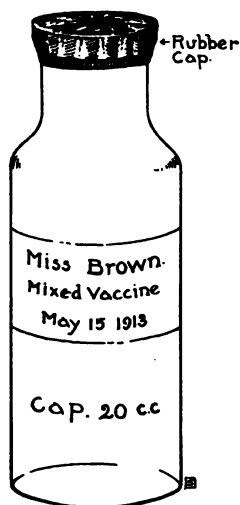


Fig. XXII.—Vaccine container, with rubber cap.



Fig. XXIII.—Individual vaccine container, sealed with gas flame.

wide-mouthed bottle an excellent container; and the small rubber cap with which some of the manufacturers preserve their culture media is an excellent means for covering the mouth of the bottle.

The vaccine, having been made and standardized, is placed in one of these bottles, after which the rubber cap is slipped over the mouth of the bottle and cresol carefully rubbed over the surface and at the margin with which it comes in contact with the bottle. When the cresol evaporates it becomes very gummy and thereby seals the bottle. In addition to this it gums over the hole made when the rubber is punctured to draw the vaccine into the hypodermic. Each dose of the vaccine can also be put into a separate tube and the ends sealed in a gas flame. When the patient is ready to be vaccinated the end of the container is broken off and its contents drawn into the hypodermic.

Technique for the Sterilization of Vaccines.

Either of the two following methods can be used for the sterilization of the vaccines:

I. The emulsion having been prepared as previously described, enough cresol is added to make a 1 per cent solution. This having been

done, the bacterial emulsion is transferred to the container which may be a bottle or small ampulla. If a bottle is used the mouth is sealed with a rubber cap and placed in a water bath at a temperature of 56° C. The vaccine is allowed to remain in the water bath for 30 minutes for 3 consecutive days. The bottle is then labeled with the patient's name and is ready for use.

II. If the above technique is not desired, enough carbolic acid can be added to the emulsion of bacteria to make a 1 per cent solution. It is then thoroughly shaken. The object of the shaking is to make as perfect a solution as possible. The solution is then transferred to a bottle and the rubber cap placed over the mouth and sealed; or each ampulla can be charged with the vaccine and sealed in a gas flame. The container is labeled with the patient's name, put in a safe place for 48 hours, and is then ready for use.

CHAPTER VIII.

Technique for Collecting Blood Corpuscles.

In a small test tube place 2 c.c. of a 2 per cent solution of sodium citrate:

Sodium citrate	2	gms.
Distilled water	100	c.c.

The most convenient point from which blood can be readily obtained is at the root of the nail of the thumb or fingers.

Having selected the point from which the blood is to be taken, the following steps are necessary: The part selected is washed vigorously with soap and water, after which it is rinsed with sterile warm water followed by rinsing in 50 per cent solution of alcohol. Place a bandage or a piece of rubber tubing around the phalanx below the one from which the blood is to be drawn. In the opposite hand hold a fine bistoury or hagadorn needle. The distal phalanx from which the blood is to be drawn is flexed and the puncture made. The first drop of blood is allowed to escape, but the remaining

TECHNIQUE FOR COLLECTING BLOOD CORPUSCLES 131



Fig. XXIV.—Showing position of tube for collecting blood corpuscles.



Fig. XXV.—Water motor centrifuge which is well suited for collecting precipitate of blood corpuscles. (Courtesy Ernst Leitz, New York.)

drops are collected in the test tube containing the citrate solution by holding the tube in such a position as will allow the blood to flow into it. (See Figure XXIV.) The blood having been collected is centrifuged for 15 minutes. The supernatant fluid is pipetted off and the blood corpuscles thus obtained are used to standardize the vaccine.

Standardization of Vaccines.

A vaccine is standardized by one of two methods. The first method is as follows: An equal quantity of an emulsion of bacteria and blood cells is drawn into a capillary pipette, after which they are thoroughly mixed by drawing the mixture back and forth from the surface of a slide. This step having been completed a smear of the mixture is prepared in the same manner as described in the technique for making a blood smear (page 61). A card is then ruled for blood cells to be counted. The count is commenced of the number of bacteria, and the blood cells in one field are counted. This step is repeated until the 20 squares have been counted. After the step of counting is completed, the content is found by the following proportion: The number of blood cells



Fig. XXVI.—Position for making emulsion of bacteria and blood corpuscles.



Fig. XXVII.—Position for making the mixture of bacteria and blood cells.

counted is to the number of bacteria counted,
as five million ($\times 10$) is to X equals the number

Chart showing method of counting and
proportion of standardizing vaccine.

Fields	Red Blood Cells	Bacteria
1	3	4
2	2	5
3	11	3
4	4	1
5	2	5
6	3	4
7	2	1
8	4	6
9	2	3
10	2	7
11	4	8
12	2	6
13	2	1
14	3	5
15	8	10
16	4	3
17	6	9
18	11	3
19	12	4
20	4	1
Total 94		88

Proportion—94 : 88 :: 5,000,000 ($\times 10X$) = Ans.

of bacteria contained in 1 c.c. of the emulsion.
Thus, for example, suppose the following to be



Fig. XXVIII.—Pipette used for mixing blood corpuscles and emulsion of bacteria, for standardizing vaccine.

correct: The number of blood cells counted in 20 squares is 94 and the number of bacteria 88. The problem would be represented thus:

$$94:88::5,000,000 (x10):X = \text{the number of bacteria contained in 1 c.c. of the emulsion.}$$

With the same precision the counting chamber of the hemocytometer can be used, and the

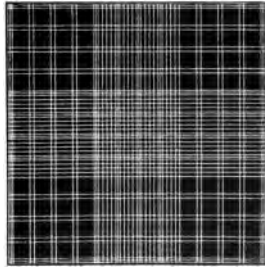


Fig. XXIX.—Türk's ruled hemocytometer.

white blood corpuscle counting pipette for making the dilution of the emulsion. To dilute the emulsion, a solution of methylene blue (which stains the bacteria blue) is used as the diluting fluid, the dilution made is one in twenty. The Türk ruling is an excellent one for this purpose. The number of bacteria contained in the large center squares are counted and then the contents of 1 c.c. is found by the following equation: The number of bacteria counted

times the dilution; times four thousand squares; over the number of squares counted; equals the contents of 1 c.m. Which, if multiplied by ten, equals the contents of 1 c.c. For example, suppose the number of bacteria counted is 250, and the dilution is one in twenty, and the number of

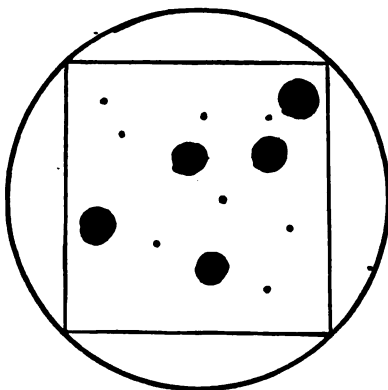


Fig. XXX.—A field as observed when counting bacteria and blood cells when a vaccine is being standardized.

squares counted 400. The problem would be represented thus:

$$\frac{250 \times 20 \times 4,000}{400 \text{ Sq. counted}} = \text{the number of bacteria to 1 c.m.}$$

which, when multiplied by ten, equals the number in 1 c.c.

After the determination of the bacterial count of the vaccine, the dose can be regulated very accurately with a graduated hypodermic.

CHAPTER IX.

Technique for Vaccination.

The point selected for vaccination can be any part of the body, the arm being the most convenient. The point selected for this purpose should be made as aseptic as possible. The tincture of iodine is an excellent agent for this purpose, though it may be said that experiment has demonstrated that the tincture of iodine does render the skin germ-free. As there is no better agent than the tincture of iodine for this purpose, its use must be contented with. If alcohol is used instead of tincture of iodine, the solutions which are antiseptic range between 50 and 85 per cent.

REACTION OF THE VACCINE.

The reaction of the vaccine is very important, as the increase or decrease of the dose depends upon it. The reaction as a rule begins from 5 to 10 hours after the vaccination and is first characterized by a rheumatic feeling of the part, which soon after is followed by ten-

derness. Inflammation then manifests itself. The arm in some instances becomes very painful on movement, and palpation at the point of vaccination is very painful. The arm in some cases is swollen for a considerable distance around the point of vaccination, causing the patient alarm. Thinking that blood poisoning has occurred, he calls at the office. This condition may cause great alarm the first time it is observed, but if the vaccine has been correctly



Fig. XXXI.—Position of arm for vaccination.

sterilized, either by fractional sterilization or carbolic acid, rest assured that the reaction thus observed is indicative of an active process in which the antibodies are being manufactured in the tissues that have the ability to raise the im-

munity of the patient. The height of the reaction is generally reached after the first 24 hours. After this time the tenderness at the point of vaccination and the surrounding tissues becomes less and less, and after the fourth day has disappeared, and the patient given a second vaccination in the other arm.

CAUTION!—At no time during the treatment vaccinate a patient in the place previously treated, because if this is done the reaction is very slight and the patient not benefited thereby. Hence, remember that at each vaccination a new point is selected, using alternate arms for the vaccination, and at a distant point from that selected at a previous time.

The index of the dose is best determined by the extent of the local reaction around the point of vaccination and the soreness of the gums after the vaccination. The soreness of the part locally, indicates a great deal to the observer, for it is soon learned that the ratio of the dose to the reaction is a good one. With the local reaction—its tenderness and inflammation, one frequently finds a similar process of the gums and the teeth. If the tenderness of the gums is very great and there is an increase of pus around the teeth involved, the patient is in

what is called a *negative stage*, and should not be vaccinated for a week. At the end of this time another dose is given smaller than the first. The first dose which the author gives is never under five hundred million and in some instances eight to nine hundred million organisms per c.c. This dosage is very heroic and many times produces a violent reaction. In some instances the patient has a chill and fever. The object of this large dose is to place the patient in a negative stage in order that it may be determined if any other teeth than those from which the culture was obtained are affected by the disease. A smaller dose is given after the first and the reaction is carefully noted at the point of vaccination, as well as the condition of the gums and state of the teeth.

CHAPTER X.

Technique for Making Capillary Pipettes.

The glass selected for making fine capillary pipettes should be soft and the lumen measure from 2 to 3 mm. The glass can be cut to any length desired, but the author generally uses a piece from 4 to 6 inches in length. The glass tubing is held in the gas flame until it becomes very soft, and as soon as this stage is reached the softened portion is grasped by a pair of thumb forceps held in the right hand. In the process of drawing the pipette the right hand is slowly moved away from the body of the glass tubing, while the left hand remains stationary. This outward movement of the hand is continued until the desired calibre is obtained. The thin capillary portion is then broken off to the desired length and bent to any angle desired. The pipette is held in the left hand until cool. A small piece of cotton is loosely packed in the opposite end to the capillary portion, after which a piece of rubber hose is slipped over this end. The pipette is then ready for use.

Technique for the Application of Drugs With Pipettes.

The rubber hose attached to the pipette is held between the lips and the pipette is firmly held by the thumb, index and second fingers of the right hand. The point of the pipette is immersed in the drug to be applied and by gentle suction any desired amount is drawn into

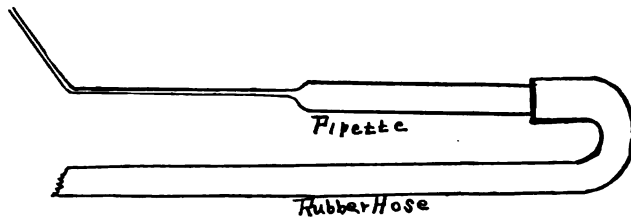


Fig. XXXII.—Pipette and attached rubber hose.

the pipette. The pipette is then gradually passed between the root of the tooth, the gum and the alveolus to the bottom of the pocket. The contents of the pipette is then discharged. The pipette is withdrawn and a piece of sterile cotton placed over the gum.

CHAPTER XI.

Local and Prophylactic Treatment.

INSTRUMENTATION.

Careful instrumentation is a very important part of the treatment and should be done with precision. The instrument should be firmly held and not allowed to slip, as considerable injury may be done to the gum and periodontal membrane if it slips and slides about in the process of scaling the teeth. The instrument should therefore be carefully and definitely placed on the root of the tooth above the deposit of tartar, and gradual and firm force exerted, while at the same time the deposit is drawn from the pocket. Repeat this step until the deposit of tartar is removed from the root of the tooth.

Do Not HURRY. Even if only one root is cleaned at a sitting and the time required to do it is one hour, be sure that the root is free from all tartar before ceasing your work.

The process of scaling is made very much

easier if the following is applied with a capillary pipette:

Phloroglucin	1	gm.
Sulphuric acid	15	c.c.
Distilled water	100	c.c.

The technique for the application of the above solution is very simple. Draw into a capillary pipette the desired quantity of the solution. Carefully pass the pipette into the deepest portion of the pocket, moving the pipette with great care from side to side, while at the same time blowing gently into the rubber hose, thus placing the solution at any desired point. As soon as the contents of the pipette has been dispatched, withdraw it from the pocket and carefully place over the gum a piece of cotton. The reaction which occurs is that of sulphuric acid on the inorganic elements of which the tartar is composed. The phloroglucin prevents a destructive action of the acid on the organic substances of an area thus treated. The advantage of the solution can be readily seen by this action. The solution loosens the deposit and makes its removal an easier matter than when an instrument is used without it. The acid solution is placed in the pocket several times while scaling the root. It is impossible to say

how many applications of this acid solution should be made. The operator must use his own judgment in its application. The tartar having been removed from the root of the tooth, the next step is to rid the lining of the pocket of the epithelium, because no union can occur between the gum and the peridental membrane unless a raw bleeding surface is present. This is generally accomplished with an acid solution or by a normal solution of potassium hydroxide (40 grams in 1,000 c.c. of distilled water). The author has secured the best results by the use of antiformin. Draw into the pipette a very small amount (not over 2 drops). Carefully pass the pipette into the pocket and with a side to side movement discharge its contents into the deeper portions of the pocket. Allow either the potassium hydroxide or the antiformin to remain in the pocket from 1 to 3 minutes, after which time neutralize with an N/10 hydrochloric acid solution. After the hydrochloric acid solution has been placed in the pocket it is swabbed out with a pledget of cotton twisted on a broach. When the treatment of the pocket with the alkalies and the acid is completed, a cataract knife is passed into the pocket and the adhering fibers of the peridental membrane which form

the boundaries of the pocket are loosened and cut. The object of this step is to induce the regeneration of the fibers and their attachment to the root and the gum which overlies the pocket. This step having been completed draw a small amount of balsam of peru containing soudan III into the pipette, again pass the pipette into the deepest portion of the pocket and discharge its contents. The pipette is then withdrawn and a pledget of cotton is placed on the gum overlying the pocket.

Balsam of peru	25	c.c.
Soudan III	1	gm.

CAUTION!—Do not treat any tooth which has not a pocket. The treatment of teeth which have no pockets is mercenary and not professional; however, do not interpret this statement to mean that tartar is not to be removed if present at the neck of a tooth. *It should be removed* and the point at which it has collected made as smooth as possible. Each tooth affected by pyorrhea should receive treatment as outlined or given similar treatment with such systemic treatment as indicated by the physician, assisted with the AUTOGENOUS VACCINES, which in practice have proven to be a most valuable adjunct in the treatment of this disease.

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